Registered at the G.P.O. for Transmission to Canada and Newfoundland by Magazine Post.

VOL. 34. Ser. A. Part 5. pp. 129-160. MAY, 1946.

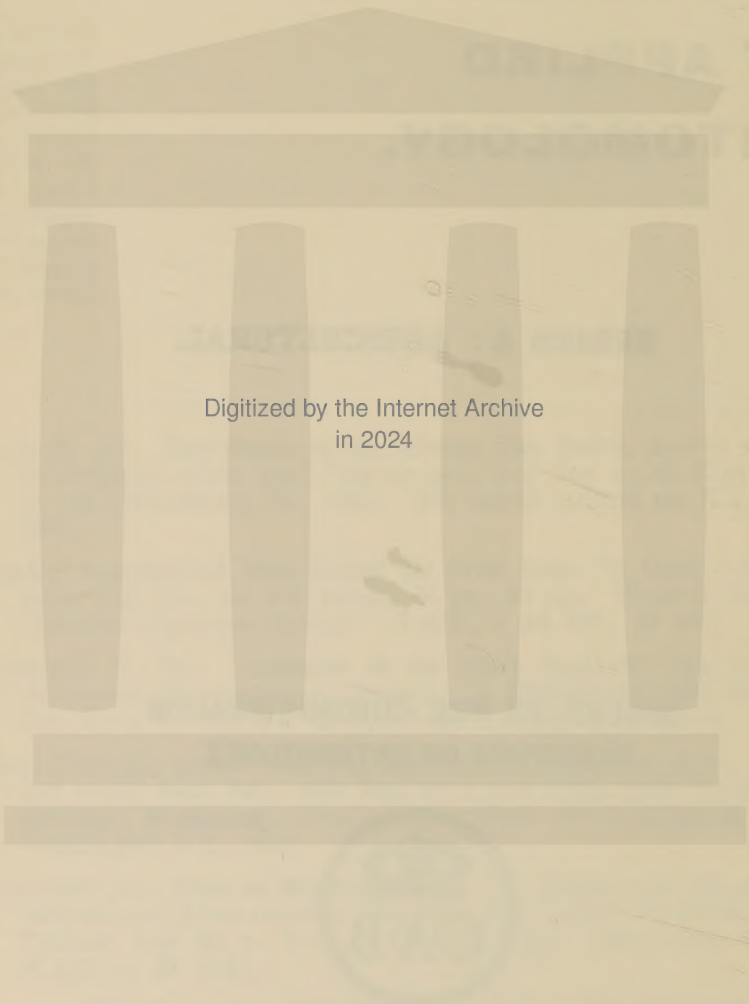
THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

ISSUED BY THE COMMONWEALTH INSTITUTE OF ENTOMOLOGY.

C·A·B

LONDON:
COMMONWEALTH INSTITUTE OF ENTOMOLOGY,
41, QUEEN'S GATE, S.W.7.



JEWETT (H. H.). **Life History of the Wireworm,** *Conoderus auritus* **(Herbst).**—*Bull. Ky agric. Exp. Sta.* no. 466, 12 pp., 5 figs., 3 refs. Lexington, Ky., 1944.

Larvae of *Conoderus auritus*, Hbst., all stages of which are described, have been found in Kentucky boring into the roots and stems of maize, wheat, tobacco and vegetables, and are injurious to crops following grass in rotation [*cf. R.A.E.*, A **29** 482]. Grasses are the preferred food-plants. In cages, eggs were laid on the surface of the soil or in crevices in it, under clods of earth and sometimes on débris on the soil, but not on plants. Females oviposited in June–July, May–July and April–June in 1940, 1941 and 1942, and lived until late August and late July, respectively, in 1940 and 1941. The egg stage lasted 8–15 days in 1941 and 10–21 days in 1942. Some of the larvae that hatched in spring gave rise to adults in the same season, but the others and those that hatched later overwintered and gave rise to adults in the following spring and summer. All adult females overwintered before ovipositing, so that the life-cycle from egg to egg lasted one or two years; but no adult overwintered a second time. The summer larvae matured in 45–84 days in 1941 and in 63–105 days in 1942, and the overwintering larvae required 380–444 and 371–416 days, respectively. No larva lived through a second winter. The pupal stage of summer larvae lasted 9–20 and 9–16 days in 1941 and 1942 and that of overwintered larvae 10–18 and 9–12 days in 1942 and 1943. Pupation of the overwintered larvae began in May in some years and in July in others.

To protect crops against *C. auritus*, grassland should be broken early in spring to discourage oviposition. Setting of tobacco plants cannot be deferred until the overwintered larvae have pupated, and it is now considered that early crops are likely to be injured less than later ones [*cf.* **29** 483] because the latter will be subject to injury by both overwintered larvae and an increasing number of newly hatched individuals.

Forest Entomology.—*Rep. Dep. Lds For. N.S. 1944*. pp. 35–65, 3 maps, 19 refs. Halifax, N.S., 1945.

A survey in Nova Scotia in 1944 indicated that infestation of spruce [*Picea*] by *Gilpinia hercyniae*, Htg., was light in all but three counties, in which it was moderate to heavy and increasing. Larvae collected during the season did not appear to be diseased [*cf. R.A.E.*, A **32** 326]. Only one outbreak of *Dendroctonus piceaperda*, Hopk., on red spruce [*P. rubra*] was recorded, but the Tortricids, *Zeiraphera fortunana*, Kearf., and *Z. ratzeburgiana*, Ratz., caused considerable injury to the new growth of spruce. Small numbers of larvae of the form of *Harmologa* (*Archips*) *fumiferana*, Clem., that attacks spruce and balsam fir [*Abies balsamea*] were found in Cape Breton Island during the year [*cf.* **32** 327]. *Chermes* (*Pineus*) *pinifoliae*, Fitch, which develops on red spruce and white pine [*Pinus strobus*], was less abundant than in 1943; the injury to spruce, consisting in the formation of galls on the new shoots, is not very great. Severe infestation by *Chermes* (*Adelges*) *piceae*, Ratz., on *A. balsamea* appeared to be limited to altitudes of less than 800 ft.

Defoliation of larch by *Coleophora laricella*, Hb., was less, and attacks were usually more scattered and patchy than in the previous year. Local infestations by *Malacosoma disstria*, Hb., occurred on various trees throughout the province; poplar and birch were completely defoliated by one of them. There was a general reduction in the numbers of larvae of *Alsophila pometaria*, Harr., on oak.

Insects attacking shade trees included *Stilpnotia salicis*, L., which has become a pest of ornamental poplars throughout Canada since it was first introduced in 1920, but has been controlled by the introduced parasite, *Apanteles solitarius*, Ratz.; it caused considerable damage, particularly in parts of Cape Breton

Island, but cocoons of *Apanteles* were present in all cases and the parasite will probably control the outbreaks in 2–5 years. *Hemerocampa leucostigma*, S. & A., and *Orgyia* (*Notolophus*) *antiqua*, L., were numerous in various places, particularly on ornamental elms and maples in towns, but generally caused only moderate damage. Adults of *Popillia japonica*, Newm., were found feeding in large numbers in a rose garden in Halifax; the beetle had not previously been recorded in Nova Scotia, but had apparently been present for several years.

Beneficial insects liberated during the year comprised *Chrysocharis laricinellae*, Ratz., and *Agathis* (*Bassus*) *pumila*, Ratz., against *Coleophora laricella*, species of *Exenterus* and *Sturmia* against *Gilpinia hercyniae*, and *Mantis religiosa*, L., as a general predator.

Die-back of birch, its possible causes and methods of control are discussed at some length [*cf.* **32** 327, etc.], and it is stated that permanent experimental plots have been established in Nova Scotia and New Brunswick to study it. The condition was frequently observed in the absence of the bronze birch borer [*Agrilus anxius*, Gory] in comparatively healthy stands in Nova Scotia, and in such instances a distinct collar occurred between the living and dead tissue of affected twigs, with browning of tissue extending from the bark and cambium into the wood. Two fungi were obtained from dead tissue immediately under the outer bark, adjacent to living tissue, and a third was cultured from darkened pith of dead twigs; one was identified as *Gelatinosporium fulvum*, the imperfect stage of *Dermatea molliuscula*.

The work of the Forest Insect Survey [*cf.* **33** 354] is briefly described, with special reference to Nova Scotia.

FORSSLUND (K.-H.). **Något om röda tallstekelns** (*Diprion sertifer* **Geoffr.**) **skadegörelse.** [The Injuriousness of *Neodiprion sertifer*.]—*Medd. Skogsförsöksanst.* no. 34 pp. 365–390, 6 figs., 9 refs. Stockholm, 1946. (With a Summary in German.)

Neodiprion (*Diprion*) *sertifer*, Geoffr., which is the commonest forest pest in Sweden, feeds on the old needles of pine (*Pinus sylvestris*) and thereby reduces the growth of the trees. An account is given of observations between 1936 and 1944 to ascertain the relative reduction caused. The terminal shoots of comparable young infested and uninfested trees in various localities were measured for several years in succession, and the results are given in detail in tables and discussed. They showed that, as compared with uninfested trees, the increase in height was about 25 per cent. less in trees that had been severely attacked for one year and about 50 per cent. less in those that had been attacked in two successive years.

Outbreaks of this sawfly are common in Sweden, and a list is given of those that occurred between 1920 and 1944, with notes on their extent and importance. The infested areas are also shown on a map. Heavy infestations are confined to the southern parts of the country, but less severe outbreaks occur even in the north. No periodicity could be detected in the occurrence of outbreaks, and their causes are not known. Weather is thought not to be a factor of importance, since larvae were observed hatching normally in May 1938 in spite of a north wind, exceptionally low temperature and a fall of snow mixed with rain [*cf. R.A.E.*, A **25** 55], and a fertilised female that was exposed in a sleeve on a pine tree during cold rainy weather in September 1940 deposited 92 eggs, which is not below the average. The cessation of outbreaks is usually attributed to natural enemies, including parasites, and the author has observed *Picromerus bidens*, L., and larvae of *Chrysopa ventralis*, Curt., preying on the larvae and eggs, respectively. A virus disease also causes mortality of the larvae from time to time.

N. sertifer occurs occasionally on *Pinus mugo* (*montana*) in Sweden and has been observed in the absence of other food to migrate from pine to spruce (*Picea abies*).

[Pospelov (V.).] **Поспелов (В.). Microbiological Method of Controlling agricultural Pests.** [*In Russian.*]—*Proc. Lenin Acad. agric. Sci. U.S.S.R.* **9** no. 7 pp. 3–8. Moscow, 1944.

The author discusses the value of entomogenous fungi and bacteria in controlling injurious insects and reviews work that has been done on them in the Russian Union. The most important of the fungi are *Metarrhizium anisopliae*, which has been used against *Cleonus* (*Bothynoderes*) *punctiventris*, Germ., on beet [*cf. R.A.E.*, A **27** 306 ; **30** 66], *Cephalosporium lecanii*, against *Ceroplastes sinensis*, Del G., on *Citrus* [*cf.* **27** 308 ; **29** 582 ; **30** 377], and *Beauveria bassiana*, which has proved effective against cereal bugs [*Eurygaster*] hibernating in litter [*cf.* **29** 583]. The optimum conditions for *B. bassiana* are a temperature of 20–28°C. [68-82·4°F.] and a relative humidity of 90–100 per cent. Larvae of *Agrotis segetum*, Schiff., and *Pieris brassicae*, L., that were sprayed with a suspension of it in the laboratory at 20–25°C. [68–77°F.] all died in six days, and it was effective in 1936 against *P. brassicae*, *P. rapae*, L., and *Loxostege sticticalis*, L., in the north (Province of Leningrad), but gave only 20–29 per cent. mortality of the larvae and not more than 40 per cent. mortality of the pupae and adults of *L. sticticalis* during hot dry weather in the south (Province of Odessa). In experiments in the Province of Voronezh, it gave 60–80 per cent. mortality of larvae of the pine Geometrid, *Bupalus piniarius*, L. [*cf.* **30** 514] on low trees overshadowed by taller ones.

Good results have been obtained with bacteria pathogenic to insects [*cf.* **27** 455 ; **29** 583], but they sometimes lose their virulence when cultured on nutritive media for long. Thus, a strain of *Bacterium prodigiosum* isolated in 1930 from diseased larvae of *L. sticticalis* retained its virulence for larvae of this moth, *Pieris brassicae* and *Pyrausta nubilalis*, Hb., for three years in culture and then became non-virulent. The reasons for this are not known, but some unfavourable factor of the medium may be involved. In 1942, the author isolated a spore-forming bacterium from *Eurygaster*. Characteristics distinguishing it from other forms are given, and the name *Bacterium eurygastoris* is proposed for it. Together with *Beauveria bassiana*, it caused considerable mortality of hibernating *Eurygaster* in the North Caucasus in 1941 and 1942. It was cultured on meat-peptone broth or on a broth of *Eurygaster*, and the whole culture was then mixed with bran, spread on newspaper and dried. In experiments in July 1942, to test its pathogenicity, the dry powder was soaked in water and a suspension of it was sprayed on to wheat infested by *Eurygaster* ; 90 per cent. of the nymphs died in four days, and the percentage mortality of nymphs that fed on a cotton-wool pad soaked with the suspension was 80 in four days, as compared with 20 in the controls. It also proved very effective in the laboratory when applied in September 1943 to cabbage leaves bearing larvae of *Pieris brassicae*, but also killed adults of the parasite, *Apanteles glomeratus*, L., that emerged from them.

[Ponomarenko (D.).] **Пономаренко (Д.). The Pink Cecidomyiid as a Pest of Seed Lucerne.** [*In Russian.*]—*Proc. Lenin Acad. agric. Sci. U.S.S.R.* **10** no. 1–2 pp. 17–20. Moscow, 1945.

Of the insects that are frequently responsible for the failure of lucerne seed crops in the Lower Volga region, *Dasyneura* (*Perrisia*) *ignorata*, Wachtl, is one of the most important. It is common there and has also been recorded on lucerne in western Kazakhstan and the Ukraine. It may complete as many as seven generations a year if the weather is wet. The larvae hibernate in cocoons

in the upper layer of soil beneath the plants, and pupation and adult emergence take place when the lucerne resumes its growth in spring. The eggs are laid in the buds, the stipules and between the top young leaves, and the larvae feed in the buds in groups of 3–8. After 10–11 days they enter the soil and form cocoons. Most of them pupate soon after, but some enter a diapause that frequently lasts until the following spring. Subsequent generations develop in the same way. This diapause, especially in the case of the first generation, preserves the species during the summer, when hot dry weather and dry winds destroy large numbers of the adults, eggs and young larvae. Infestation prevents the production of seed but does not affect the plants in any other way.

All varieties of lucerne are infested, but the larvae are most abundant on lucerne grown for seed in spring. Since the development of the Cecidomyiid is favoured by humidity, irrigated lucerne suffers more ; on one farm, up to 28·3 per cent. of the buds were infested in irrigated fields, and only 0·2 per cent. in those cultivated dry. The population increases only in rainy seasons, and the rate of infestation in spring is high if the preceding season was wet, while a dry autumn and spring reduce it considerably. *D. ignorata* does not migrate far and gradually accumulates in fields of old lucerne ; thus the percentage of infested buds on irrigated lucerne of the first mowing on one farm averaged 3·2, 21·6 and 51·6 in fields of the second, third and fourth year, respectively. Infestation decreases as conditions become less favourable in summer and is comparatively slight on irrigated lucerne grown for seed after a first hay crop. This method of utilising the crop checks an increase of the pest towards the end of the season, which is favoured by using the first crop for seed and the second for hay.

Infestation is best prevented by sowing new fields at some distance from older ones. Irrigated lucerne should be allowed to produce a hay crop in spring before being grown for seed, but old non-irrigated lucerne may be grown for seed in spring provided that it has been used exclusively for hay in the preceding season.

KLEIN (H. Z.) & PAKER (M.). **Biological Studies on the Mediterranean Fruit Fly (*Ceratitis capitata* Wied.) in the Jordan Valley.** [*In Hebrew.*]—*Bull. agric. Res. Sta. Rehovot* no. 32, 33+7 pp., 7 figs., 3 refs. Rehovot, 1942. (With a Summary in English.)

The results are given of field and laboratory investigations carried out in 1937–41 on the bionomics of *Ceratitis capitata*, Wied., in the Jordan Valley [*cf. R.A.E.*, A **26** 406]. In trap-glasses maintained throughout the year in a grapefruit grove, 90 per cent. of the total catch was obtained during May-June, when fruit suitable for oviposition was not available in the groves ; the catch was negligible in the months of highest and lowest temperature. The percentage of females was greatest in spring and autumn and lowest in summer, and drought (in May) and extreme heat (in August) caused a reduction in the number of gravid females and the number of eggs per female. Infested fruits were examined during the picking season. Large numbers of living eggs were present in the oviposition holes in November and April, but there were none in most of the holes in winter ; the greatest number of oviposition holes per fruit was 38 and the greatest number of eggs per hole 60. The numbers of fruits containing larvae rose steadily from the end of winter onwards.

Host fruits, which include *Citrus*, other subtropical and tropical fruits, plums and grapes, are present all the year round. In the laboratory, guava was preferred to all other fruits or vegetables for oviposition, and green pepper [*Capsicum*] and tomato were accepted, but not lemon, custard apple [*Annona squamosa*], Ceylon gooseberry [*Aberia gardneri*], passion fruit (*Passiflora edulis*), egg-plant [*Solanum melongena*], or prickly pear [*Opuntia*]. No oviposition occurred in fruits of tomato, green pepper and egg-plant that were

hung in grapefruit trees at the peak of infestation, although the grapefruits were heavily attacked. In breeding experiments there was a maximum of 6–7 generations in the year, although there are probably not more than five in the field [*cf.* **26** 407; **28** 270], and the developmental period varied from 57 days at approximately 16°C. [60·8°F.] to 17 at about 30°C. [86°F.]. Development ceased at 12°C. [53·6°F.] [*cf.* **30** 402]. Adults lived for 1½–7 months, flies that emerged in early autumn surviving until spring. In May, when the dry desert wind (khamsin) was blowing, and in August, during very hot weather, many adults lived for only a very short time. Pupae in the soil were killed by cold in winter and by drought in May. All flies died in 19 days at a temperature of 2°C. [35·6°F.] and in 13 days when deprived of food. Those that were supplied with food but denied fruit suitable for oviposition lived longer than those kept under normal conditions in summer, but not in winter. Natural mortality in the course of development averaged 70 per cent. Reproduction was greatest at 27°C. [80·6°F.], and the maximum number of progeny per female was 180. In winter, there was little activity during the day unless the temperature rose to about 14°C. [57·2°F.].

In the Jordan Valley, *C. capitata* can reproduce continually either on *Citrus* alone or on native fruits such as figs, grapes and dates, and it is also favoured by the recent introduction of new fruit varieties such as Surinam cherry [*Eugenia uniflora*], white sapota [*Casimiroa edulis*] and guava. The adults fly for short distances only, and infestation in a grove tends to be localised, but they are carried to other groves by the strong winds that prevail throughout most of the year. No parasites or predators are known to attack *C. capitata* in Palestine, and disease has been found only in pupae in wet soil. It is concluded that the spread of the fly through the Jordan Valley cannot under present conditions be prevented. Partial control is possible in specific orchard areas by picking *Citrus* fruits early, and keeping the trees free from them from early April until the end of summer, and prompt removal of infested fruit in autumn would probably give some control in winter and spring, but it is doubtful whether the cost would be justified. Bait-sprays of tartar emetic, sugar and water could be applied if summer fruits are infested.

LIZER Y TRELLES (C. A.). **Insectos y otros enemigos de la quinta.** [Insects and other Enemies of Market Gardens.]—*Enciel. agropec. argent.* no. 2, 2nd edn., 7×5½ ins., 217 pp., 20 figs. Buenos Aires, Edit. Sudamer. S.A., 1944. Price $2.50 *m/n.*

This booklet is intended for growers of vegetable crops in Argentina, and deals chiefly with insects. Following two introductory chapters on the general characters and mode of development of insects, mites and Nematodes, and the usual methods of controlling them, separate chapters are devoted to the principal Orders of insects. The characters of each Order are briefly described, and information is given on the appearance, bionomics, food plants and control of the various species that are pests of vegetables in Argentina. Two short chapters on mites and Nematodes are included. The book has an index to the pests dealt with and another to the plants.

HARRINGTON (C. D.). **Biological Races of the Pea Aphid.**—*J. econ. Ent.* **38** no. 1 pp. 12–22, 2 figs., 11 refs. Menasha, Wis., 1945.

The following is largely taken from the author's summary. During 1941 and 1942, collections of *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) were received from twelve widely separated pea-growing areas of the United States and tested under uniform greenhouse conditions in California to determine whether more than one biological race of the insect is present in the country. The results obtained with nine Aphid lines collected in the autumn of 1941

and tested in the spring of 1942 have already been noticed [*R.A.E.*, A **31** 405]. Experiments involving comparative feeding injury, body size and rates of reproduction indicate that *M. onobrychis* is a species-complex, composed of many races. All data obtained were subjected to appropriate statistical analyses, and on this basis the 31 Aphid lines tested were tentatively assigned to five separate biological races.

EBELING (W.). **Properties of Petroleum Oils in Relation to Toxicity to Potato Tuber Moth Larvae.**—*J. econ. Ent.* **38** no. 1 pp. 26–34, 16 refs. Menasha, Wis., 1945.

The following is based on the author's summary. Experiments carried out in California to ascertain the value of larvae of *Gnorimoschema operculella*, Zell., as test insects in the determination of the insecticidal effectiveness of oils and solutions of insecticides in them showed that accurate determinations of small differences in toxicity could be made with only 50 larvae per test, divided into five samples of ten. Each sample was tested by pouring 1 ml. oil on a disk of paper towelling at the bottom of a 100-ml. beaker and placing the ten larvae on it. The larvae became completely covered with an oil film, and the period required for five of the ten to die (M.L.P.) was recorded, a larva being considered dead as soon as it ceased to move when prodded with a dissecting needle. No oil was found in the intestinal tracts of larvae that had been immersed in stained oil for several hours, and it was assumed, therefore, that the death of the larvae was not hastened by ingestion of the oil.

Data are given to show the great differences in M.L.P. obtainable with oil solutions of some common insecticides. There appeared to be no relation between the viscosity and distillation range of the regular *Citrus* spray oils and their toxicity to the larvae, but kerosene, which has a much lower viscosity and distillation range and is much more volatile at the temperatures at which the experiments were made, was more toxic. This is attributed to the disappearance of excess kerosene from the bodies of the larvae, a condition found to be conducive to greater insecticidal effectiveness of oils; there was no significant difference in M.L.P. when the larvae were completely immersed in the two liquids. No difference was found between the toxicity of naphthenic base (Western) oils and paraffinic base (Eastern) oil, but the toxicity of both types increased as the percentage of unsulphonated residue decreased, and the unsaturated hydrocarbons were also found to increase the toxicity of spray oils to larvae of *Musca domestica*, L. It is suggested that the superiority of the paraffinic base oils to the naphthenic base oils against certain insects or insect eggs may be due to the physical nature or oxygen permeability of the oil or oil film rather than to the toxicity of the oil, as larvae of *G. operculella*, which are very susceptible to changes in the toxicity of oil, survived as long when immersed in paraffinic oil as in naphthenic oil.

It is concluded from a review of the literature that the petroleum hydrocarbons removable from spray oil by treatment with sulphuric acid or by the sulphur-dioxide process may increase the effectiveness of the oil against insects and eggs, may have no apparent effect because suffocation takes place before toxic action is possible, or may reduce the effectiveness of the oil, presumably by an adverse effect on the physical nature of the oil film.

CARTER (Walter). **Soil Treatments with special Reference to Fumigation with D-D Mixture.**—*J. econ. Ent.* **38** no. 1 pp. 35–44, 5 figs., 12 refs. Menasha, Wis., 1945.

The following is based on the author's summary. The study of soil fumigation was begun in 1936 in Hawaii as a result of evidence that as pineapple soils became older the pathological complex in them increased in severity, and

that some contrary action was necessary if production was to be maintained ; a second reason was the observation that first ratoons grown on virgin land and in some cases on land treated with chlorpicrin were less susceptible to mealybug wilt [caused by *Pseudococcus brevipes*, Ckll.] than were ratoons on old land [*cf. R.A.E.*, A **33** 249]. Weed killers and various organic soil amenders proved unsuitable, but among a considerable number of chlorinated compounds, a mixture of 1,3-dichlorpropylene (1,3-dichlorpropene), 1,2-dichlorpropane and isomers of these compounds was at least as effective as chlorpicrin and had none of its disadvantages. This mixture (D-D) can be used effectively without soil cover, is particularly effective in soils infested with Nematodes and resulted in especially significant gains in an area where larvae of *Anomala* [*orientalis*, Waterh.] are important factors in a complex that includes *Heterodera* and fungi of the genus *Pythium* [*cf.* **31** 360 ; **32** 374].

The 1,3-dichlorpropylene fraction of the mixture is evidently the most toxic, but there is synergism between it and other fractions, which suggests that its combination with other chlorinated compounds might be a basis for additional research on soil fumigants.

Plant growth is considered the best criterion of the value of a soil fumigant, and it is believed that whatever the effect of the fumigant on individual species of the soil complex, the development of good root systems follows effective fumigation.

ROMNEY (V. E.), YORK (G. T.) & CASSIDY (T. P.). **Effect of *Lygus* spp. on Seed Production and Growth of Guayule in California.**—*J. econ. Ent.* **38** no. 1 pp. 45–50, 2 figs., 6 refs. Menasha, Wis., 1945.

The following is substantially the authors' summary. Under irrigated conditions in California, guayule (*Parthenium argentatum*) remains in flower from early spring to late autumn. It has been found to be a very favourable food-plant for several plant bugs, the most important of which are *Lygus hesperus*, Knight, and *L. sallei*, Stål [*cf. R.A.E.*, A **33** 105]. *L. hesperus* occurs throughout the extensive guayule plantings in central and northern California, whereas *L. sallei* occurs only along the coast.

In experiments in 1943 and 1944, *L. hesperus* reduced the weight and viability of the seed in both laboratory and field cages. It attacked seeds in the pre-dough stage as long as they were available, and when they were lacking fed on the current season's shoots, inhibiting subsequent growth and flowering. *L. sallei* feeds primarily on the terminal growth, causing plants on which it feeds to appear yellowed and stunted as though diseased [*cf. loc. cit.*] ; when the insects were removed, the damaged plants resumed normal growth after several months, indicating that the injury was due to their feeding and not to disease.

CASSIDY (T. P.), ROMNEY (V. E.) & YORK (G. T.). **The Role of Arsenicals in reducing *Lygus* Injury to Guayule Seed.**—*J. econ. Ent.* **38** no. 1 pp. 50–51, 4 refs. Menasha, Wis., 1945.

The results are given of two experiments carried out in California in 1943 in which six applications of dusting sulphur alone and with calcium arsenate (2 : 1) and Paris green (8 : 1), calcium arsenate alone and 50 per cent. cryolite were made to plots of guayule [*Parthenium argentatum*] infested with *Lygus* spp. at approximately weekly intervals in May–June and July–August, respectively ; the *Lygus* population consisted almost entirely of *L. hesperus*, Knight. Seeds that were in the susceptible stage during the periods of treatment were collected when ripe and allowed to germinate. With the exception of cryolite, all treatments caused significant reductions in the nymphal population in both series, but these did not appear great enough to afford effective

control; there was no significant difference between them. The effect of the arsenicals, either with or without sulphur, in increasing the percentage of viable seed, however, was significant and greater than the relatively slight decrease in the numbers of *Lygus* would have suggested, probably because the surviving insects had ingested enough poison to cause a loss of appetite.

QUESTEL (D. D.). **Comparative Effects of Spray and Dust Treatments on European Corn Borer.**—*J. econ. Ent.* **38** no. 1 pp. 52–56, 3 graphs, 2 refs. Menasha, Wis., 1945.

The following is mainly based on the author's summary. Field tests of insecticides against *Pyrausta nubilalis*, Hb., on maize carried out at Toledo, Ohio, during several seasons have consistently shown a wide range in the extent of control obtained with spray and dust treatments. Laboratory and field tests were therefore carried out to determine what caused this by finding how, when and where the larvae were killed by each of the treatments. In the laboratory experiments, dusts of ground derris root containing 4 per cent. rotenone, alone and diluted with pyrophyllite to give 0·25–1 per cent. rotenone contents, applied to sheets of waxed paper, caused complete mortality of newly hatched larvae deposited on them. On sheets similarly dusted and then wetted and dried to simulate the effect of dew or rain, pyrophyllite alone caused higher mortality than derris alone, apparently because the derris dust remained caked, whereas the pyrophyllite became dusty again after drying and interfered with the progress of the larvae so much that they died from exhaustion and desiccation before they could crawl off the paper. The physical condition of the dust was evidently a more important factor in its efficiency than its rotenone content.

In the field experiment, dissections of maize plants were made in plots sprayed and dusted with derris and in an untreated plot, beginning a few days after the first application and continuing daily, whenever possible, until approximately a week after the last one. The numbers of living and dead larvae found were, respectively, 634 and 1,703 for the sprayed plot, 1,154 and 795 for the dusted plot and 3,622 and 40 for no treatment. About 99 and 97 per cent. of the larvae killed by the spray and dust treatments, respectively, had died before they reached the third instar. The spray killed a high percentage of larvae on the outer leaves and in the favourite feeding places of the young borers, such as in the whorl, between the leaf and the stalk and in the ear shoots, whereas the dust, although it killed nearly as high a proportion on the outer leaves, was only about half as effective in the more protected sites and less than a quarter as effective in the tassels. Rainfall appeared to increase the mortality caused by the sprays, but reduced the efficiency of the dusts, and spray residues remained effective considerably longer than the dust residues.

WALKDEN (H. H.). **Reproductive Capacity of the Hessian Fly.**—*J. econ. Ent.* **38** no. 1 pp. 56–58, 4 refs. Menasha, Wis., 1945.

The abdominal volumes of 641 newly emerged females of different generations of *Mayetiola* (*Phytophaga*) *destructor*, Say, that emerged from puparia collected in 1921–25 from various localities in the central part of the United States in which hard or soft winter wheat is grown were measured, and the numbers of eggs they contained were determined by dissection. The abdominal volumes ranged from 0·12 to 2·12 cu. mm. and the number of eggs from 25 to 388; there was a positive correlation between the number of eggs and the volume of the abdomen. The average numbers of eggs per female were 185 in flies that emerged from winter puparia collected in October and

November and 205 in those from puparia of the first and second spring generations collected from ripening wheat just before harvest in June. Within these groups they were 191 and 203, respectively, in flies from areas of soft wheat and 163 and 211 in those from areas of hard wheat. All these figures are lower than those recorded for flies from the area of soft winter wheat in Pennsylvania [*cf. R.A.E.*, A **10** 240].

PEPPER (B. P.) & CARRUTH (L. A.). **A new Plant Insecticide for Control of the European Corn Borer.**—*J. econ. Ent.* **38** no. 1 pp. 59–66, 9 refs. Menasha, Wis., 1945.

The following is largely based on the authors' summary. Ryanex, a new proprietary insecticide prepared from the tropical plant, *Ryania speciosa*, was tested against *Pyrausta nubilalis*, Hb., on maize under field conditions in New Jersey and New York in 1943 and 1944. In preliminary tests in 1943, the control given by undiluted Ryanex dust was considered the most effective obtained up to that time in New Jersey, and was better than that given by other dusts in neighbouring plots in New York. More extensive comparative tests in 1944 in both States indicated that a 50 per cent. Ryanex dust was more effective in reducing the number of borers per 100 plants and increasing the percentage of saleable ears than dusts containing 4 per cent. fixed nicotine, 1 per cent. rotenone as cubé, or 2 per cent. fixed nicotine with 0·5 per cent. rotenone, except in one New York test in which the degrees of control were essentially comparable ; it was about as effective as 3 per cent. actual DDT. A spray of 4 lb. Ryanex per 100 U.S. gals. was more effective than sprays of cubé (4 per cent. rotenone) at the same strength or of 3 lb. nicotine bentonite (14 per cent. fixed nicotine) per 100 U.S. gals. and about equal to 1 lb. actual DDT per 100 U.S. gals.

A dust containing 30–50 per cent. Ryanex appears to be the most useful at present, though there are indications that lower concentrations are effective. When the normal programme of 4–5 applications at intervals of five days was modified by reducing the number of treatments and lengthening the interval between them, all the partial schedules tested gave high percentages of saleable ears and low borer populations when 50 per cent. Ryanex dust was used ; it appeared that the later treatments may be more important than the earlier ones. In New Jersey, dusting with 50 per cent. Ryanex was much more effective at the rate of 25 lb. per acre than at 20 lb., although the lower rate gave excellent protection of the ears. Higher rates were more effective. In New York, 20 lb. per acre was less effective than 35 lb., but there was little difference between 35 and 50 lb., whether tillers were present or not. No appreciable differences in effectiveness were observed between 40 per cent. mixtures prepared with talc, pyrophyllite, tobacco powder, or talc and sulphur. The 50 per cent. dust, applied to commercial plantings with power dusting equipment and with smaller dusters, provided good practical control in tests in New Jersey and in preliminary trials in New York.

BAKER (E. W.). **Studies on the Mexican Fruitfly known as *Anastrepha fraterculus*.**—*J. econ. Ent.* **38** no. 1 pp. 95–100, 6 figs., 5 refs. Menasha, Wis., 1945.

The following is based on the author's summary. An account is given of investigations on the bionomics of the fruit-fly known as Mexican *Anastrepha fraterculus*, which occurs in the States of Veracruz, Morelos, Tamaulipas and Coahuila in rose apple (*Eugenia jambos*), guava, peach and tropical almond (*Terminalia catappa*), and may be a source of danger to fruit-growing regions of the United States if it proves to be identical with the typical (South American) *A. fraterculus*, Wied. [*cf. R.A.E.*, A **33** 397]. In the laboratory,

grapes and coffee berries were preferred for oviposition, but no larval development occurred in them ; peach, jobo [*Spondias*], pear, guava, loquat and plum were readily infested. In studies on the food requirements of the adults, a diet of sugar and water was sufficient to sustain life, but the addition of a protein (brewers' yeast or casein) to the normal diet of orange, sugar and water increased egg production. Oviposition began 20 days after emergence, and the incubation period ranged from 50 hours at 30°C. [86°F.] to 239 hours at 15°C. [59°F.] and was 55·5 hours at 32·5°C. [90·5°F.]. The larval stage in plum sections ranged from 10 days at 27·5°C. [81·5°F.] to 21 days at 17·5°C. [63·5°F.] and development in the puparia from 10·5 days at 30°C. to 35 days at 17·5°C. The duration of total development ranged from 26·93 days at 27·5°C. to 67·5 days at 17·5°C. and was 28·06 days at 30°C. Some flies were still alive at the end of eight months.

BRANNON (L. W.). **Control of Mexican Bean Beetle and Corn Earworm in the Presence of Powdery Mildew on Snap Beans.**—*J. econ. Ent.* **38** no. 1 pp. 101–102, 5 refs. Menasha, Wis., 1945.

The control of *Epilachna varivestis*, Muls., on the autumn crop of snap beans in eastern Virginia is often complicated by the presence of *Heliothis armigera*, Hb., and powdery mildew (*Erysiphe polygoni*), and field experiments were therefore carried out in the autumn of 1941 to determine the comparative effectiveness of combinations of derris and sulphur and cryolite and sulphur against all three pests. Sprays were applied at a rate of approximately 140 U.S. gals. per acre and a pressure of 250 lb. and cryolite and derris dusts at 17 and 28 lb. per acre, respectively, under a light cloth trailer about 12 ft. long. Applications were made on 17th September, when the plants were in bud, and on 2nd October, when they were in full bloom. A dust of cryolite and sulphur (70 per cent. sodium fluoaluminate) gave a significantly higher yield than one of cryolite and talc with the same proportion of insecticide, although the results against the two insects were comparable, because the sulphur was effective against the fungus [*cf. R.A.E.*, A **25** 189], and an equally higher yield than one of derris and sulphur (0·5 per cent. rotenone) although the control of *Epilachna* and mildew were comparable, because derris is ineffective against *Heliothis*. There was a similar difference, which was significant but less marked, between a spray of 3·81 lb. cryolite (89·3 per cent. sodium fluoaluminate) and 2 lb. wettable sulphur per 50 U.S. gals. and one of 2 lb. per 50 U.S. gals. of a mixture of derris and wettable sulphur containing 0·015 per cent. rotenone. The dust of cryolite and sulphur was significantly more effective than the corresponding spray, probably because of its higher sodium-fluoaluminate content, but the difference between the derris spray and dust was not significant.

HAEUSSLER (G. J.). *Gambrus stokesii* **Cam., an Australian Parasite of Codling Moth and Oriental Fruit Moth.**—*J. econ. Ent.* **38** no. 1 pp. 103–106, 4 refs. Menasha, Wis., 1945.

Cocoons of *Agrothereutes* (*Gambrus*) *stokesi*, Cam., which parasitises pupae of *Cydia* (*Carpocapsa*) *pomonella*, L., and *C.* (*Grapholitha*) *molesta*, Busck, in Australia, were received in New Jersey in March 1938 and gave rise to adults in March–April. The results obtained from experimental and routine breeding work carried out in 1938–39 and observations on the development and habits of this Ichneumonid under laboratory conditions are given in this paper.

The adults were provided with absorbent cotton saturated with a 10 per cent. solution of honey in water as food. They mated readily in cages and seven fertilised females lived for an average of 41 days and deposited an average of 116·1 eggs when provided daily with host cocoons spun in corrugated paper.

The females oviposited readily in cocoons containing pupae of either *C. pomonella* or *C. molesta*, but showed a definite preference for the former. Eggs were only occasionally deposited in cocoons containing hibernating larvae of *C. pomonella* and never in those containing pupae of *Pyrausta nubilalis*, Hb., exposed under laboratory conditions. The preoviposition period lasted 24–48 hours, and egg-production was greatest at 70–80°F. and 60–80 per cent. relative humidity. The eggs are laid loose in the host cocoon; several were often deposited by individual females in one or two cocoons while others in the same cage received none, and as one of the newly hatched larvae destroys all the others that it encounters, the eggs were removed from the cocoons and placed singly in gelatine capsules with one host pupa per parasite. Larvae from eggs deposited on each species were reared on pupae of both, and others were reared on hibernating larvae that had been rendered inactive by immersion for five minutes in water at 54°C. [129·2°F.]. The minimum incubation period was 30 hours at 80°F. and 50 hours at 70°, and the larval feeding stage averaged about 4·5 days for larvae reared at 80° on pupae of *C. pomonella* or *C. molesta* and about 3 days and 1 day longer, respectively, for those on inactivated larvae of the two species. The parasite larva feeds externally on its host; it usually constructed its cocoon inside the pupal skin of *C. pomonella* and outside that of *C. molesta* or the shrunken remains of inactivated larvae. The larvae entered the prepupal stage 2–3 days after they had finished feeding on inactivated larvae or pupae of *C. molesta* and 4–5 days after they had done so on those of *C. pomonella*, and the prepupal and pupal stages lasted about 24 hours and 5–6 days at 80°F., respectively. The life-cycle averaged 15 days on pupae of *C. molesta*, 17 days on inactivated larvae of *C. molesta* and pupae of *C. pomonella* and 21 days on inactivated larvae of *C. pomonella*; the development of the females was usually slightly slower than that of the males.

Attempts to rear *A. stokesi* by placing eggs in capsules with normal hibernating larvae of either species of *Cydia* or with pupae of *P. nubilalis* were unsuccessful. When mature larvae in cocoons were stored for nine months at a temperature of 42°F., 60 per cent. subsequently gave rise to adults, whereas comparatively few individuals survived when similarly stored in the prepupal or pupal stage; it is therefore considered that the parasite overwinters as a mature larva. A higher percentage of female parasites developed from eggs that had been deposited in the cocoons containing pupae of *C. pomonella* than from those laid in cocoons containing pupae of *C. molesta*, regardless of the species of the pupae on which the larvae were reared, and it is concluded that the sex of the progeny is fixed at the time the egg is deposited [*cf. R.A.E.*, A **25** 678]. In the case of parasites that hatched from eggs laid in cocoons of *C. pomonella* and were reared on inactivated larvae, the percentage of females was higher when the host was *C. pomonella*, but only 20 parasites were reared on inactivated larvae of *C. molesta*, and two host larvae were required to complete the development of each.

A total of 6,447 adults was reared, of which 2,647 were females, and 2,585 females were released in 13 States, usually in orchards interplanted with apple and peach, or at points where peach and apple plantings adjoined; no attempts have been made to determine whether the parasite has become established.

SMALLMAN (B. N.). **Relation of Insect Damage to Thiamine Content of Biscuits.**—*J. econ. Ent.* **38** no. 1 pp. 106–110, 4 graphs, 8 refs. Menasha, Wis., 1945.

Since it has been shown that mortality is high and development retarded when larvae of *Tribolium confusum*, Duv., are reared on hard biscuits of the type issued to the armed forces as emergency rations, as compared with control insects in flour, investigations were carried out on the nature of the deficiency responsible. The biscuit formula was 100 gm. flour, 5 gm. sugar, 8 gm. milk

powder, 1·5 gm. soda (sodium bicarbonate), 38 ml. water and a variable amount of fat (hydrogenated ground-nut oil). The following is based on the author's summary. Flour was modified, first by baking it as a paste of flour and water and then by baking it as a paste containing soda as in the biscuit formula. The extent of growth, rate of development and number of eggs laid by beetles reared on the materials and on complete biscuits containing 2 and 12 per cent. fat were determined and related to changes in the thiamine content induced by the baking process. Baking the flour, especially when it was made alkaline by the addition of the soda, resulted in the destruction of thiamine and a marked reduction in ability to support normal growth and reproduction. The growth of moulds on the biscuits caused an increase in the reproduction of *Tribolium*. Growth, development and oviposition were all retarded to a greater extent in the biscuits containing fat, and this retardation was the more pronounced for the higher fat content. This effect can hardly be attributed to thiamine deficiency, and no explanation of it is offered.

EICHMANN (R. D.). **Squash Bug Depredations in Washington.**—*J. econ. Ent.* **38** no. 1 pp. 110–112, 8 refs. Menasha, Wis., 1945.

An account is given of the outbreak of *Anasa tristis*, Deg., on cucurbits in Washington that began in 1937, and the severe damage it has caused to winter squash in the Yakima Valley [*cf. R.A.E.*, A **33** 21], possible methods of control are briefly discussed, and it is reported that the infestation appeared to be losing its outbreak proportions in 1943 [*loc. cit.*], probably owing to cold winters and the curtailment of squash production. *A. tristis* has two generations a year in the Yakima Valley, where the growing season lasts 160–190 days. The adults emerge from hibernation in early June and their feeding on the stems of the seedling squash plants at ground level causes most of the destruction of plants. Nymphs and adults of the first generation develop during July and August, respectively, and nymphs of the second generation soon after, but these are less injurious because they feed chiefly on the leaves. Hibernating adults develop in late September and October.

STEINER (H. M.). **Factors affecting Survival of Plum Curculio in Peach Orchards.**—*J. econ. Ent.* **38** no. 1 pp. 116–117, 1 fig. Menasha, Wis., 1945.

The factors known to affect the survival of the plum curculio [*Conotrachelus nenuphar*, Hbst.] in peach orchards include the number of generations a year, frequency of crop failure, availability of shelter for overwintering adults, prevalence of infested trees near the orchards, relationship between temperature and moisture at certain critical periods during the season and intensity of sunshine on fallen fruits containing eggs and young larvae. The author briefly discusses the effect of some of them on populations of this weevil in orchards in southern Pennsylvania during recent years and describes an experiment carried out to obtain further information on survival, in which samples of infested fruits collected on 1st June 1944 were left outdoors under different conditions until the adults emerged. It was found that soil type and site of pupation affected the time of emergence, which was latest from sand in sun and from soil under dry mulch, and that light late rains induced sharper peaks of emergence from sand than from other soils. Survival was lowest in the densest soil and greater when the fruits were on a loose soil surface than when they were on a slaked surface crust. The use of mulch equivalent to 2½ tons dry grass per acre under the fruits induced shallower pupation and lower survival both in sunlight and in partial shade than other cultural treatments, but the addition of water equivalent to 1 in. rainfall on the mulch increased the survival. The results of cultivation to a depth of 2½ ins. suggest that this

treatment is not highly effective where deep pupation occurs. The survival from fruits in sunlight was much lower than from fruits in partial shade, but the burial of fruits in sunlight more than doubled the survival.

STEINER (H. M.). **Ground Cover Sprays to kill Insects and Weeds in Peach Orchards.**—*J. econ. Ent.* **38** no. 1 pp. 117–119, 1 ref. Menasha, Wis., 1945.

Since the use in peach orchards of sprays containing weed-killers instead of cultivation to reduce weed and cover-crop competition at critical times would permit the accumulation of surface litter, which reduces water and soil losses during heavy rains, tests were carried out in Pennsylvania in 1944 to find suitable materials that would also kill certain insects and thus prevent them from migrating to the trees in search of food. Two that gave outstanding results as regards their effect on the weeds were a powder containing 40 per cent. dinitro-ortho-cyclohexylphenol and a preparation designed for use in oil sprays and containing 1 lb. pentachlorphenol per U.S. quart. They were used at rates of 2 lb. and 2 U.S. quarts, respectively, with 2 U.S. gals. petroleum oil and 2 oz. of a proprietary spreader and emulsifier per 100 U.S. gals. spray, and the sprays were applied at the rate of 250 U.S. gals. per acre. In tests of their insecticidal value, insects collected in neighbouring orchards were caged over grass and the sprays were applied at half strength. Adults of two species of *Melanoplus*, the tarnished plant bug [*Lygus oblineatus*, Say] the buffalo treehopper [*Ceresa bubalus*, F.], the Japanese beetle [*Popillia japonica*, Newm.] and the plum curculio [*Conotrachelus nenuphar*, Hbst.] were all killed when the sprays were applied directly to them, and *Melanoplus*, *Lygus* and *Ceresa* when they were caged over freshly sprayed grass. *P. japonica* and *C. nenuphar* died after entering grass wet with the dinitro spray, but not grass treated with pentachlorphenol. Both species of *Melanoplus* died within 24 hours of being placed over grass that had been sprayed with either mixture and allowed to dry for two hours. In the orchard, dead and dying examples of *Melanoplus* and *L. oblineatus* were found on weeds and on the ground within a few minutes after treatment.

The growth of the trees was not affected by the sprays, and three-year-old trees were not injured when 10 U.S. gals. of either mixture was poured on the surface of soil near them, except when the pentachlorphenol mixture touched the trunk of one, but wilted within 24 hours and eventually died when 30 U.S. gals. was applied in the same way. The dosage necessary to kill insects and weeds when a pressure sprayer, ground boom and drag sheet are used is considered unlikely to injure the trees provided that the materials are kept away from the trunk and foliage.

MARVIN (P. H.). **Effectiveness of *Macrocentrus ancylivorus* reared from Strawberry Leaf Roller in parasitizing Oriental Fruit Moth.**—*J. econ. Ent.* **38** no. 1 p. 119. Menasha, Wis., 1945.

Adults of *Macrocentrus ancylivorus*, liberated for the control of the oriental fruit moth [*Cydia molesta*, Busck] in the United States are commonly reared from the strawberry leaf roller [*Ancylis comptana*, Froel.]. It had been thought that they might not attack *C. molesta* so readily as do adults reared from the latter, but the experiment described indicates that they do. Six cages each containing two small uninfested peach trees were stocked with equal numbers of adults of *C. molesta*. A week later, five females of *Macrocentrus*, reared from field-collected larvae of *Ancylis*, were put in two of the cages and five females reared from field-collected larvae of *Cydia* in two others, in each case with some males, while two were left as controls. Insects were

reared from infested twigs cut from the trees 7 and 11 days later, and it was found that 62 of 555 from the first two cages, 62 of 681 from the second two, and none of 626 from the two control cages were *Macrocentrus*.

ALLEN (H. W.). **Sources of overwintering** *Macrocentrus ancylivorus*.—*J. econ. Ent.* **38** no. 1 pp. 119–120. Menasha, Wis., 1945.

Although the populations of *Macrocentrus ancylivorus*, Rohw., that overwinter in bearing peach orchards of the principal commercial varieties in the United States are relatively low, the parasite appears in large numbers in such orchards during the presence of the first generation of *Cydia* (*Grapholitha*) *molesta*, Busck, in many districts. It is considered that this is due to the migration of adults from neighbouring sources more heavily stocked with overwintering parasites. In southern New Jersey, the parasite commonly overwinters in *Ancylis comptana*, Froel. (*fragariae*, Walsh & Ril.) on cultivated strawberry, but the area devoted to this crop is very small. In the autumn of 1943, however, it was found that several species of wild and cultivated blackberry and dewberry and the cultivated red raspberry supported moderate to heavy populations of overwintering larvae of *A. comptana*, which were, in most cases, extensively parasitised by *M. ancylivorus*, and that the wild plants are abundant and widely distributed throughout the area in which peaches are grown. The estimated numbers of overwintering larvae of *A. comptana* in patches of dewberry and blackberry averaged 2,050 and 1,000 per 1,000 sq. ft., respectively, as compared with 50 per 1,000 sq. ft. in cultivated strawberry in the same district. The percentage parasitism by *M. ancylivorus* averaged 6–16 on blackberry and 21·3 on dewberry. In cultivated blackberry and red raspberry, which appear to be grown over a larger area than strawberry, the percentages were 32 and 43, respectively. Other plants were found to be infested by *Ancylis*, but *Macrocentrus* was absent or very scarce on them; it was also not numerous in overwintering examples of the ragweed borer, *Epiblema strenuana*, Wlk.

BARTLETT (B. R.) & MARTIN (C. H.). **A chemical Method of freeing Cocoons of** *Macrocentrus ancylivorus* **from Tuber Moth Cocoons.**—*J. econ. Ent.* **38** no. 1 p. 120, 2 refs. Menasha, Wis., 1945.

FINNEY (G. L.). **Separating** *Macrocentrus* **Cocoons from Tuber Moth Pupae.**—*T.c.* p. 120.

The technique described in the first of these papers was designed to avoid the loss of time involved in keeping cards bearing cocoons of *Gnorimoschema operculella*, Zell., parasitised by *Macrocentrus ancylivorus*, Rohw., until the moths have emerged from the unparasitised ones [*cf. R.A.E.*, A **32** 367], and to permit the parasite cocoons to be separated and shipped some time before the adults are due to emerge from them. It consists of scraping the cocooning material from the cardboard to which it adheres and washing off silk and extraneous cocooning material by immersion in a 1·3 per cent. solution (by weight) of sodium hypochlorite. As this is slowly stirred, the silk is dissolved and the moth pupae and parasite cocoons rise to the surface. They are then removed, rinsed and mechanically separated. In preliminary tests this treatment did not appear to affect the emergence of adults of either species.

The possibility of using sodium hypochlorite as a contact-spray adjunct to control pests that are protected by silken webs is suggested.

In the second paper, the author states that cocoons of *Macrocentrus* can readily be separated from pupae of *Gnorimoschema* without apparent injury to either by putting them in 95 per cent. alcohol. The moth pupae sink and the floating parasite cocoons can be skimmed from the surface within 30 seconds.

JONES (S. C.). **DDT as a Control for Cherry Fruit Fly.**—*J. econ. Ent.* **38** no. 1 p. 122. Menasha, Wis., 1945.

In preliminary tests of the value of DDT for the control of *Rhagoletis cingulata*, Lw., on cherry in Oregon, fruit and foliage were dusted with a mixture of electric sulphur and talc containing 2 or 3 per cent. DDT, or sprayed with 5 per cent. DDT in oil at concentrations of 1, 2 or 4 pints per 100 gals. water or with a preparation containing 20 per cent. DDT and a spreader, used at concentrations of 1 or 2 lb. per 100 U.S. gals., and placed in cages with ten flies immediately afterwards. Sucrose solution was put in the cages to prevent starvation, and observations were made at 8-hour intervals until 50 per cent. mortality was reached. All the preparations acted slowly; the 2 and 3 per cent. dusts killed half the flies in 80 and 88 hours, respectively, and the sprays required at least 88 hours to do so. At least half the flies were alive in untreated cages after 384 hours.

In field tests, a plot of sweet cherries interplanted with prune trees and surrounded by a severely infested orchard was dusted with a mixture of equal quantities of electric sulphur and talc containing 2 per cent. DDT six days after the first flies began to emerge, and a small isolated orchard, which had been severely infested in 1943, with 3 per cent. DDT in the same carrier eight days after emergence began. Examination of fruit taken at random showed an infestation of 3,356 larvae in 2,476 cherries in the first case and 1,089 in 3,452 cherries in the second, indicating that one application of DDT at these concentrations was not effective.

JONES (S. C.). **Ground Treatment with DDT to control Pear Thrips in Soil under Prune Trees.**—*J. econ. Ent.* **38** no. 1 p. 122. Menasha, Wis., 1945.

In a series of tests on the control of *Taeniothrips inconsequens*, Uzel, in Oregon, Gesapon no. 18, a proprietary preparation containing 5 per cent. DDT in solution, was applied to the soil under prune trees, near the peak of emergence, at concentrations of 1 gal., 2 quarts and 1 quart per 100 gals. water. Each concentration was applied at the rate of 1 U.S. gal. per sq. yard. One thrips emerged from soil treated with each of the first two concentrations and none from that treated with the third, as compared with 561, 541 and 14 from equal areas of adjacent untreated soil.

SUN (Yun-pei). **Effect of Rotenone and Velsicol (AR-60) Dusts on the Control and Reproduction of Bean Aphids.**—*J. econ. Ent.* **38** no. 1 pp. 124–125, 4 refs. Menasha, Wis., 1945.

Mortality alone may not always indicate the effectiveness of an insecticide for the control of Aphids, since treated individuals may reproduce rapidly before they die, so that there is no great decrease in population. This possibility was studied by dusting batches of 25 mature apterae of *Aphis rumicis*, L., on nasturtium leaves with talc, with or without the addition of various proportions of derris powder (3·1 per cent. rotenone) and of 1 or 2 per cent. Velsicol (AR-60), which is stated to be a preparation of methylnaphthalenes. The results were recorded 24 hours later. The mortality and (in brackets) the numbers of young produced per 100 Aphids averaged 4·7 (321, all living) for talc alone. When 0·023–0·078 per cent. rotenone was added, the averages were 80·8–100 (420–342, most or many of which were living), and as the rotenone content increased from 0·15 to 0·47 per cent., they were 100 (273–102, some or a few of which were living). For talc and 1 per cent. Velsicol alone, the average was 44·3 (26, many of which were living), and mortality and production of young were both increased with the addition of rotenone, mortality being complete with the addition of 0·039 per cent. The numbers of young

produced fell from 168 (many living) to 42 (all dead) as the rotenone concentration rose from 0·023 to 0·31 per cent. The dust containing 2 per cent. Velsicol gave complete mortality of the parent Aphids with or without rotenone; the presence of rotenone in most cases increased the numbers of young produced, though none survived.

It is concluded that rotenone in dusts tends to stimulate the reproduction of *A. rumicis* while Velsicol reduces it, and similar results were given in preliminary tests with *Brevicoryne brassicae*, L., and *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.). This may account for the unsatisfactory results obtained with rotenone against some Aphids in the field [*cf. R.A.E.*, A **28** 173].

FISHER (E. H.) & STANLEY (W. W.). **Preliminary Tests with Sabadilla.**—*J. econ. Ent.* **38** no. 1 pp. 125–126. Menasha, Wis., 1945.

The material used in the tests described, which were carried out in the laboratory in Tennessee in September 1944, was a proprietary sabadilla concentrate that contained 50 per cent. ground seeds of *Schoenocaulon officinale*, treated with alkali [*cf. R.A.E.*, B **33** 65–66]. It was diluted for use with pyrophyllite to give concentrations of 2·5–20 per cent. sabadilla. The 20 per cent. dust caused knockdown (paralysis) of all adults of *Murgantia histrionica*, Hahn, in five minutes and all were dead in 15 hours; 5 and 10 per cent. dusts caused slower knockdown and incomplete kill, and a 2·5 per cent. dust required 45 minutes for complete knockdown and gave only 73 per cent. kill in 72 hours, though 7 per cent. of the remaining bugs were moribund. Against nymphs, the 20 per cent. dust gave only 80 per cent. knockdown in 30 minutes, though 93 per cent. were dead and 7 per cent. moribund in 72 hours, and the 2·5 per cent. dust caused no knockdown in 30 minutes, though 40 per cent. of the bugs were dead and 33 per cent. moribund in 72 hours. It is concluded that 5–10 per cent. dusts should give effective control of *M. histrionica*, and dusting green sprouting broccoli heavily infested by adults with a mixture of sabadilla, alkali, sulphur and pyrophyllite (10 : 10 : 40 : 40) at the rate of 35 lb. per acre on 4th October gave considerable control. In a repetition of the test when the plants were wet with dew, the action of the dust was much quicker, and a good kill was obtained.

Larvae of *Plathypena scabra*, F., were unable to move one hour after being dusted with 20 per cent. sabadilla, but had nearly all recovered after 18 hours. They did not eat dusted bean foliage in one test for three days, and all were dead on the sixth day; 10 per cent. sabadilla had less contact effect, but prevented the larvae from feeding.

The 20 per cent. dust was the most effective against *Epilachna varivestis*, Muls. When larvae and adults were dusted and then placed on clean leaves there was little mortality, but when undusted insects were put on treated leaves, 72 per cent. of the larvae and 20 per cent. of the adults were dead in three days; the larvae ate little of the treated foliage and the adults hardly any. When both insects and bean leaves were dusted, the 20 per cent. mixture gave 74 and 80 per cent. kill of larvae and adults, respectively, in 72 hours; the knockdown effect was greater on the adults, and 90 per cent. of them were moribund in one test after 24 hours. Larvae fed little on foliage sprayed with sabadilla (1 : 340), and only 10 per cent. were dead in 3 days.

The 10 and 20 per cent. mixtures appeared to be equal in effect against larvae of *Heliothis armigera*, Hb.; larvae more than half grown refused to eat dusted beans for 36–48 hours, after which they fed on them but suffered only slight mortality. Complete knockdown of *Blattella germanica*, L., was obtained in ten minutes and complete kill in about 40 hours when 50 per cent. sabadilla was used; 20 per cent. sabadilla was slower in action and 10 per cent. had little toxic effect, though the knockdown was increased from 10 to 90 per cent. in 24 hours when sulphur was used as the carrier.

MICHELBACHER (A. E.) & SWANSON (C.). **Factors influencing Control of the Walnut Aphid.**—*J. econ. Ent.* **38** no. 1 pp. 127–128. Menasha, Wis., 1945.

Although nicotine dusts give exceedingly good control of *Chromaphis juglandicola*, Kalt., on walnut, proper timing of treatments and some knowledge of the relationship between the Aphids and their natural enemies are essential. In an infested orchard in northern California in 1944, the Coccinellid, *Olla abdominalis*, Say, was abundant from early in the season, but the Aphid increased rapidly. It was numerous but not very injurious by 18th May, when Coccinellids were found in all stages of development, and Syrphid adults were seen in numbers. The Aphid population was no greater by 29th May, and all stages of *O. abdominalis* and adults of *Hippodamia* were very abundant. Syrphids and Chrysopids were also present, and it was evident that the predators were rapidly controlling the Aphids. Despite this, a nicotine dust was applied on 5th June. It killed almost all the Aphids and led to the disappearance of the predators, but Aphids were again increasing by 24th July, probably owing to immigration from untreated orchards, and were very injurious by 7th August, when few Coccinellids were present, although Syrphid and Chrysopid larvae were fairly common. Dusting with nicotine on 8th August gave satisfactory control of the Aphids for the rest of the season.

It is considered that if the first application of dust had been omitted, the Aphid and its natural enemies would have reached equilibrium, and the second very large and destructive outbreak would not have occurred; this view was supported by the fact that undusted orchards in the same area suffered less damage than the one under observation.

BUMGARDNER (R. J.). *Cybocephalus* **established in California.**—*J. econ. Ent.* **38** no. 1 p. 128, 1 ref. Menasha, Wis., 1945.

The introduced Nitidulid of the genus *Cybocephalus* that was liberated against *Aonidiella aurantii*, Mask., on commercial *Citrus* and ornamental plants in Orange County, California, in 1934 [*cf. R.A.E.*, A **22** 577], could not be found in later inspections. Ten years later, however, it was observed in two places there feeding on *Diaspis boisduvali*, Sign., infesting native *Opuntia*, and on *Diaspis cocois*, Licht., infesting *Cocos plumosa*. It was quite numerous, but did not appear to have caused much reduction in the population of either Coccid.

MOUL (E. T.). **Notes on** *Arilus cristatus* **(Linnaeus) in York County, Pennsylvania and on its Prey (Heteroptera : Reduviidae).**—*Ent. News* **56** no. 3 pp. 57–59. Lancaster, Pa., 1945.

During the summers of 1943 and 1944, *Arilus cristatus*, L., was common in York County, Pennsylvania, where it is usually scarce, and collections were made of feeding adults and nymphs. Their prey included Lepidopterous larvae, Coleoptera and Hemiptera, but consisted mainly of adults of *Popillia japonica*, Newm., with some of *Chalepus dorsalis*, Thnb., and the prevalence of the Reduviid was associated with a local increase in the numbers of these beetles. Egg-masses of *A. cristatus*, each containing 75–150 eggs, were common during the winter on the trunks and branches of forest and orchard trees and grape-vines; they were generally deposited within 4 ft. of the ground, but without regard for protection or cover. Feeding nymphs were first collected on 3rd June, and the last adults were taken on 11th October. Mating was observed on 23rd and 29th August.

STRICKLAND (E. H.). **Could the widespread Use of DDT be a Disaster ?**—*Ent. News* **56** no. 4 pp. 85–88, 1 ref. Lancaster, Pa., 1945.

In view of a statement that many species of insects were almost completely eliminated over an area of 20 acres of forest land in Pennsylvania by treatment with DDT, the author points out the risks that may be associated with the use of this insecticide over large areas. If a pest were eliminated by DDT, its parasites would either be destroyed with it or would die out for lack of food, since any alternative hosts they might have would presumably also have been eliminated. In subsequent years, the pest would invade the treated area from outside, and could then increase unchecked, as it is unlikely that its parasites would accompany it in sufficient numbers to exert control, since they are in flight at different seasons of the year. Furthermore, outbreaks of insects that are not normally pests, because they are controlled by parasites, might well occur for the same reason and necessitate the frequent application of control measures not previously required.

WATSON (J. R.). *Herse cingulatus* **Fab. as an Armyworm.**—*Florida Ent.* **27** no. 3 p. 58. Gainesville, Fla., 1944.

Larvae of the Sphingid, *Herse cingulata*, F., are not uncommon on sweet potato in Florida, but are usually scattered over the fields and are rarely abundant in any one place. During the first week of July 1944, however, they were observed near Santa Fe in large bands that moved across the sweet-potato fields, defoliating the plants as they went. One field, 30 acres in extent, was completely defoliated in this manner and several others suffered damage. Most of the larvae were nearly full-grown, but a few were only half developed. Wild morning-glory was abundant in the surrounding fields and woods and was probably the source of the infestation.

MUNRO (J. A.). **Wheat Stem Sawfly and Harvest Loss.**—*Bi-m. Bull. N. Dak. agric. Exp. Sta.* **7** no. 4 pp. 12–16, 2 figs., 1 ref. Fargo, N. Dak., 1945.

Cephus cinctus, Nort., the life-history of which is briefly described, is injurious to wheat in north-western North Dakota, eastern Montana and the prairie provinces of Canada. Injury in North Dakota was severe in 1916, 1923, 1929, 1943 and 1944 ; in the last year, when the percentage of stems infested ranged up to 75 or more, investigations were made on the extent to which infestation causes loss of crop. There was no appreciable difference in the weight of grain from 300 infested and 300 uninfested stems examined in August, and the chief loss is that due to the lodging of infested stems, which are difficult to harvest. Prompt harvesting of infested crops is generally recommended, since high winds or rain cause more stalks to fall, and observations on the yield from five infested and five uninfested fields that were harvested on different dates in August showed that there was a tendency for losses to increase with delay in harvesting, and that the average loss of grain per acre in the infested fields was nearly seven times that in the others. The wind was strong enough to blow infested stalks over on most days in August. Though wind is believed to be the most important factor determining the amount of loss, the type of harvesting machinery employed is also important, since more grain is believed to be lost following straight combining [by the use of the harvester-thresher] than by the use of the binder, which is more readily lowered to retrieve the heads of stems that are bent but not broken. The larvae also caused slight damage to flax in North Dakota in 1944, but, in all instances observed, they died before they could descend to the base of the plant [*cf. R.A.E.*, A **33** 98].

Infestation can be reduced or prevented by means of cultural methods [*cf.* **29** 112], which include the use of clean summer fallows and the planting of

resistant crops, such as sweet clover [*Melilotus*], flax, maize, potatoes and oats in infested fields. Late-sown spring wheat is less subject to infestation than early, and, in some areas, good protection is given by sowing a marginal strip the width of one drill at least 7–10 days before the rest of the field, to attract the ovipositing females. This measure is even more effective if a bare strip of the same width is left between the trap strip and the main crop. Infestation is increased when one susceptible crop follows another, especially if the seed is sown in the stubble or there is no preparation of the seed-bed other than shallow tillage at sowing time. Control is more difficult where strip cropping is necessary to prevent soil drift, especially if the stubble remains undisturbed until after the adults have emerged.

BARBER (G. W.). **Mineral Oils, alone or combined with Insecticides, for Control of Earworms in Sweet Corn.**—*Tech. Bull. U.S. Dep. Agric.* no. 880, 83 pp., 11 figs., 20 refs. Washington, D.C., 1944.

A detailed account is given of the investigations carried out in Connecticut, Florida and New Jersey in 1935–41 on the injection of mineral oils, with or without additional insecticides, into the tips of the ears of sweet maize for the control of *Heliothis armigera*, Hb. [*cf. R.A.E.*, A **31** 274]. The larvae enter the ears continuously during the first week or so following silk exposure and larvae of all instars may be present. They usually penetrate to the kernels by the time they are in the fifth and sixth instars, though this is dependent on the length and tightness of the husk, which vary with variety and to some extent with moisture conditions. The method of treatment and the equipment used are described.

Preliminary tests showed that a white mineral oil was as effective as the best of the vegetable oils used, and was almost or quite as effective alone as the latter with the addition of insecticides. The effectiveness of mineral oils alone was little affected by viscosity, and the lowest effective dose was about 0·75 ml. per ear inserted 0·5 in. into the silk-mass. The oil tended to run through loose interior silks but remained as a film about the strands of more tightly packed silk, forming a barrier that smothered the younger larvae and obstructed the larger ones. It had considerable ovicidal effect, but emulsions were ineffective. Since the ears of most varieties of sweet maize have rather loose silks, oil alone did not usually afford sufficient protection, and better results were given by adding 0·2 per cent. pyrethrins or 2 per cent. dichlorethyl ether to it [*cf.* **29** 217; **30** 267]; other insecticides were less effective. The mixture of oil and pyrethrins, which acted as a contact insecticide, was most effective in ears with short loose husks, and that with dichlorethyl ether, which acted as a fumigant as well, in those having longer, tighter husks. Oils in the lower viscosity range were the best for use with either material [*cf.* **29** 217], and the mixtures were the most effective in ears in which the husk extended well beyond the tip, so that the larvae were killed before they could reach the kernels.

Since larvae killed in the fifth or sixth instars give an objectionable appearance to the ears if their bodies decompose in them, the treatment should be applied while the larvae are small. The rate of decomposition of dead larvae was often correlated with the character of the husks, as the oil protects their bodies from the air in tightly packed ones. Larvae that enter the ear by boring through the husk are more numerous in treated than in untreated ears, because the oil repels them from the silks, but in the two States for which data are given, the proportion of ears affected by such larvae was not high enough to cause material loss; it is considered desirable, however, to apply the treatment to all ears in a field whether they are marketable or not, in order to kill as many larvae as possible [*cf.* **30** 268]. The treatment should be applied

after fertilisation is complete [*cf.* **28** 520 ; **33** 337] and did not appreciably affect the flavour of the maize [*cf.* **29** 217]. Its commercial practicability is discussed.

GOULD (G. E.). **The Biology and Control of the Striped Cucumber Beetle.**—*Bull. Ind. agric. Exp. Sta.* no. 490, 28 pp., 1 fig., 65 refs. Lafayette, Ind., 1944.

Diabrotica melanocephala, F. (*vittata*, F.) is the most important insect pest of cucurbits in the United States and causes serious damage to cucumbers, cantaloupe melons and watermelons in Indiana in almost all years. The results are given of investigations on its bionomics and control carried out in Indiana between 1935 and 1942 ; some of them have already been noticed [*R.A.E.*, A **25** 30 ; **28** 177]. It is stated in a footnote that 5 per cent. of the beetles collected on plots of cucurbits on 9th July 1942 differed in markings from the typical form and are considered by H. S. Barber to represent an undescribed species.

The adults of *D. melanocephala* are polyphagous and have been recorded on 61 plants in 20 families ; a list is given of seven additional plants on which they were observed to feed. The overwintered beetles fed on many flowering plants, chiefly Rosaceae, and on wild cucumbers in spring, but migrated to cultivated cucurbits, which are preferred, as soon as the seedlings appeared. On older plants, they fed for preference on the flowers. Feeding by the larvae was, in general, restricted to the underground parts of cucurbits, though they attacked the rind of the fruits of watermelon, cantaloupe and squash in late summer and when infestation was heavy.

There are two overlapping generations a year, and adults were numerous from late April until the first frosts in autumn. Large-scale migrations of the overwintered adults into the fields coincided with the appearance of the cucurbit seedlings above the ground, and sudden large increases in population with periods of high temperature and humidity in the summer. Mating occurs throughout the summer and was observed as early as April. Laboratory experiments indicated that a moist environment is required for the eggs to hatch, and in the field they are deposited in loose, moist soil near the food-plants. The egg, larval and pupal stages lasted about 1, 2–3 and 1 week, respectively, and the adults remained in the pupal cells for a day or two. Adults of the first generation were first observed in the field about mid-July and oviposited until the end of August, and the second-generation adults emerged from 20th August until the first frost and overwintered under leaves and other débris on south slopes in wooded areas. Some survived throughout the following summer.

In addition to causing serious direct losses, *D. melanocephala* is of importance as it transmits *Bacillus* (*Erwinia*) *tracheiphilus*, the causal organism of bacterial wilt of cucurbits. Cucumbers were found to be the most susceptible to this disease, followed, in order of increasing resistance, by cantaloupe, squash and pumpkin ; watermelons were not affected by it. Losses may be as high as 30–40 per cent., but are thought to average about 20 per cent. in cantaloupes and rather more in cucumbers. Some evidence of varietal differences in susceptibility was noted among cucumbers and cantaloupes.

Larvae of the Telephorid, *Chauliognathus pennsylvanicus*, Deg., fed on the larvae of *D. melanocephala*, and the adults were attacked by birds in summer and mice in winter. The most important natural enemy was the Tachinid, *Chaetophleps setosa*, Coq. [*cf.* **25** 720], which parasitised the adults. The percentage parasitism varied considerably from week to week, depending partly on the number of newly-emerged beetles present, but was normally 15–25. Many females were parasitised before ovipositing, but some of them were able to deposit a few eggs before they died. A parasite larva emerged

on 15th May from a beetle collected two days previously and may have overwintered in it. The pupal stage of *C. setosa* lasted about a week in August, and complete development lasted at least 23 days in June and July and 34 in August. There are probably 4–5 generations during the summer.

Preliminary tests in cages and small plots showed that the beetles were very resistant to the insecticides used. Dusts of barium fluosilicate gave the highest mortality (about 75 per cent. when undiluted or at dilutions of 50 or 25 per cent.), and derris, cryolite and calcium arsenate killed 50–60 per cent. Pyrophyllite was the most effective diluent, followed by talc. Hydrated lime frequently caused severe scorching on cucumber and cantaloupe foliage. In field tests, a dust containing 20 per cent. calcium arsenate and enough of an insoluble copper compound to provide 3 per cent. metallic copper was the most effective on both cucumber and cantaloupe ; one containing 20 per cent. cryolite also gave good results, but the effectiveness of cryolite dusts was reduced when an insoluble copper compound was included. A dust containing 20 per cent. calcium arsenate alone was third in effectiveness. Dusts containing barium fluosilicate killed the beetles, but scorched and stunted the plants. Derris dusts gave high mortalities at the time of application, but the plots were re-infested two or three days later. A dust comprising a carrier impregnated with pyrethrum extract immobilised many beetles, but they quickly recovered. Sprays containing calcium arsenate with copper compounds were also tested, but were not very effective. Those containing Bordeaux mixture always injured the foliage [**28** 178], and those containing insoluble copper compounds also caused some injury, though it was less severe.

On the basis of these investigations, it is recommended that dusts be applied to cucumbers on the day of germination and 4, 8, 13, 18, 24, 30 and 37 days later ; if rain occurs, the application should be repeated. On cantaloupes, the interval following the fifth and later applications should be extended by a day or two. The cost of applying various dusts is discussed. The yield of both cucumbers and cantaloupes from treated fields was found to be more than twice that from untreated fields in most seasons.

ESSIG (E. O.). **A new Aphid on Guayule and Notes on other Species of** *Cerosipha*.—*Hilgardia* **16** no. 4 pp. 177–184, 6 figs., 6 refs. Berkeley, Calif., 1944.

The author describes the alate and apterous viviparous females and the first-instar young of the Aphid, *Cerosipha californica*, sp. n., which was found in California in small bark and root cavities made by wireworms and other insects on seedlings of guayule (*Parthenium argentatum*) in July 1942, on the leaves of French prune in November 1928 and on the roots of potato in May 1944, and states that alates found on tomato in Oahu, Hawaii, and provisionally identified as *Vesiculaphis caricis*, Fullaway [*R.A.E.*, A **33** 251] also belong to this species. He gives a key to the five known species of the genus *Cerosipha* and notes on the morphology of the four previously described.

LINSLEY (E. G.). **Natural Sources, Habitats, and Reservoirs of Insects associated with Stored Food Products.**—*Hilgardia* **16** no. 4 pp. 187–224, 7½ pp. refs. Berkeley, Calif., 1944.

The following is substantially the author's summary of this paper, which is based on the literature and his own observations. Insects attacking stored food products are widely distributed in nature and also in warehouses, granaries and houses, probably owing to a broad range of tolerance of physical factors of the environment, a wide range of food habits and the optimum conditions for existence frequently provided by man-made structures. Several of the species involved, such as Bruchids, *Calandra* (*Sitophilus*) spp. and

Sitotroga cerealella, Ol., infest seeds in nature, and have become stored-seed pests without having to undergo further evolution of food habits. Many insects (Cryptophagids, Mycetophagids and Lathridiids) and mites associated with stored products are fungus feeders. In nature, they are found under bark, in the nests of birds, mammals and insects, in decomposing plant material and in any other places where there are moulds and fungi. General scavengers on dead plant materials, principally Phycitines and Pyralines but also Anobiids and Nitidulids, and scavengers on dead animal materials, including *Dermestes* spp., *Piophila casei*, L., and *Tineola biselliella*, Humm., attack products of similar origin stored by man. Many pests of stored products, such as almost all the Tenebrionids, Cucujids and Trogositids, appear to have been derived from scavengers, fungus feeders and predators that live under bark, and a few, including Ptinids, Anobiids, Bostrychids and Scolytids, are derived from wood-boring types and retain boring characteristics, attacking either whole grains and seeds or processed foods of a compact nature. A number of pests, particularly several of the Galleriines, Phycitines, Ptinids and Dermestids, may have come originally from the nests of bees, wasps, ants and other insects, and the pollen stored in bees' nests may have assisted the evolution of their food habits by bridging the gap between plant and animal foods. Many insects in stored food products are predators and parasites of other insects present; a few of these are probably attracted to the products and habitat directly rather than by any specific insects present.

Primary natural reservoirs are to be found in bark and decomposing wood, the nests and food caches of other insects, especially bees, wasps and ants, and the nests of birds and rodents.

Sinclair (W. B.) & Ramsey (R. C.). **The Picric Acid Method for determining minute Amounts of Hydrocyanic Acid in fumigated Insects.**—*Hilgardia* **16** no. 6 pp. 291–300, 1 fig., 3 graphs, 13 refs. Berkeley, Calif., 1944.

Lindgren (D. L.) & Sinclair (W. B.). **Relation of Mortality to Amounts of Hydrocyanic Acid recovered from fumigated resistant and nonresistant Citrus Scale Insects.**—*T.c.* pp. 303–315, 6 graphs, 14 refs.

In the first of these papers, details are given of a method of determining the amount of hydrocyanic acid gas absorbed and retained by fumigated insects, by which amounts ranging from 0·005 to 0·2 mg. can be determined, though the most suitable range is 0·01–0·1 mg. It involves distilling a sample of insects in water acidified with sulphuric acid into sodium-carbonate solution, heating the distillate with picric-acid solution and taking a colorimeter reading. Some insects, such as *Tribolium confusum*, Duv., give off volatile reducing substances during the distillation, and the method has the disadvantage that these are usually carried over with the steam into the receiving flask and subsequently react with the alkaline picrate, so that preliminary distillations on the unfumigated insects are essential to determine whether such substances are present. Most of the insects tested were free from them, and partial success was achieved in eliminating them when they were present by redistilling the distillate at a lower temperature.

In the second paper, investigations carried out to determine the basis for the difference in reaction of resistant and non-resistant races of Coccids to fumigation with hydrocyanic acid gas are described. Attempts were made to evaluate separately the influence of concentration of HCN and exposure on the mortality of the two races of *Aonidiella aurantii*, Mask., and to correlate the mortality of fumigated resistant and non-resistant races of *A. aurantii* and *Saissetia oleae*, Bern., with the amounts of HCN recovered from them, the effects of varied dosages, exposures and previous treatments on absorption and mortality being studied. When resistant and non-resistant mature

females of *A. aurantii* were fumigated with 0·4–3·9 mg. and 0·19–1·6 mg. per litre, respectively, for ten minutes, or with 0·4 mg. per litre for 10–90 and 2½–25 minutes, respectively, the non-resistant race was the more affected by change in both exposure and dosage. When females of the two races were fumigated with 16 mg. HCN per litre for 1–10 minutes and HCN was recovered immediately after treatment by the technique described in the first paper, much larger amounts were obtained from the non-resistant than from the resistant individuals for all exposures. When females first killed by high temperature or lack of oxygen were fumigated, more HCN was recovered from the non-resistant than from the resistant individuals, but the difference was less than in those fumigated without pre-treatment. When females killed by fumigation with HCN were re-fumigated five hours later, four hours having proved sufficient for complete dissipation of the absorbed fumigant, more HCN was recovered from resistant than from non-resistant individuals, but when scales that had been killed by fumigation 19 days before and were completely dried were re-fumigated, equal quantities were recovered from the two races. From these results it is concluded that the difference in the amount of HCN absorbed is not entirely due to the mechanism of respiration, as has been thought [*R.A.E.*, A **29** 535].

Comparison of the mortality curves with the curves obtained when the amounts of HCN recovered were plotted against the concentration or exposure indicated that the amount recovered from the two races is directly related to their mortality.

More HCN was recovered from non-resistant than from resistant individuals of *S. oleae* and more from puparia of *Rhagoletis suavis* var. *completa*, Cress., preconditioned and fumigated at 15–20 per cent. relative humidity than from those preconditioned and fumigated at 70–90 per cent. Less was recovered per unit weight from the puparia than from resistant or non-resistant females of *A. aurantii*, which are more susceptible to HCN.

McClintock (J. A.) & Fisher (W. B.). **Spray Chemicals and Application Equipment. A Text Book and Hand Book of the Insecticide-Fungicide Industry and of Application Equipment.**—11×8½ ins., 320 pp., many illustr., 78 refs. LaGrange, Ind., Horticultural Press, 1945. Price $4. (Abroad $5.)

The first part of this book comprises information on the historical development, chemistry, manufacture, toxic properties and uses of the various compounds employed in pest control, mainly but not exclusively in sprays, and includes some previously unpublished data on manufacturing processes. In the second (pp. 193–303), the various types of spraying and dusting equipment are briefly described and their advantages and disadvantages summarised. The book is illustrated with numerous photographs of manufacturing plant and processes, the application of various insecticides, and types of equipment made by different manufacturers.

Liu (Tiao-hua). **Studies of the Rice Hesperiids (*Parnara guttata* Bremer) in Liuchow.** [*In Chinese.*]—*Bull. Kwangsi agric. Exp. Sta.* no. 3, 18+60 pp., 54 figs., 1 map, 14 refs. Liuchow, 1935. (With a Summary in English.)

Parnara guttata, Brem., damages rice in three districts of Kwangsi and usually produces five generations a year [*cf. R.A.E.*, A **26** 244], though more may develop if the winter is mild. Under normal conditions, the adults emerge at intervals of about a month, or rather longer at the beginning and end of the season, from about the end of April until early October. They commonly feed on nectar in flowers of *Artemisia*. The females oviposit a day or two after mating and lay about 80 eggs; they survive for 4–5 days, and the

males for 3–4. The egg stage generally lasts six days and the pupal stage about eight, but both are dependent on temperature. The larval stage lasts 18–19 days in summer and over six months in the overwintering generation. The larvae injure lowland rice from mid-May until mid-June and again from mid-August until mid-September, when damage is more severe. They overwinter in grass and at the edges of rice-fields, ponds and ditches. The eggs, larvae and pupae are attacked by parasitic and predacious insects and the larvae by several diseases.

Effective control measures include the application of dusts of tobacco, pyrethrum or mixtures of the two, and the use of mechanical devices including a comb-like harrow that is dragged over the plants. Varieties with smooth, slender leaves are the most susceptible to attack.

CHIU (Shin-foon). **The Bionomics and Control of the Rice Stem Borer** (*Schoenobius incertellus* **Walker**). [*In Chinese.*]—*Fukien J. Agric.* 1942 repr. [2+] 68 [+2] pp., 7 pls. (4 fldg.), 6 fldg. tables, 170 refs. [? Fuchow] 1942. (With a Summary in English.)

Schoenobius bipunctifer, Wlk. (*incertellus*, Wlk.) is probably the most important pest of rice in Kwangtung and becomes particularly injurious at intervals of a few years. It has four or five overlapping generations a year, of which the first two feed on the spring crop and the others on the autumn crop. In 1933, the spring crop throughout the Province was heavily infested by it, and studies on its bionomics and control were made at Canton between November 1933 and June 1935.

The eggs were laid in batches of about 70 on the upper surface of the leaves and hatched in 3–18 days. The larvae fed in the stems, at first in groups of 2–5 and later singly, migrating from stem to stem when their food-supply was consumed or became unsuitable. The plants did not become infested until the ears emerged, but produced no grain if they were infested soon afterwards ; the first week after ear emergence is regarded as the critical period. The larval, prepupal and pupal stages lasted 23–37, 1–4 and 8–9 days under favourable conditions in summer ; the larvae pupated in silken cocoons in the lower parts of the stems. Overwintering larvae were found in their cocoons in the rice stubble, at or just below the surface of the ground, and pupated in March, the pupal stage then lasting about three weeks. They were most numerous in fallow fields, and some are probably killed by winter cultivation [*cf. R.A.E.*, A **27** 613]. Adults of five generations were collected in the field in 1934, and females represented 92·4 per cent. of all those taken. Adults of both sexes lived for up to a week in the laboratory ; the females usually began to oviposit three days after emergence, provided that they had paired, and laid about two batches of eggs. The moths were most numerous in July and could be caught in light-traps throughout most of the night.

The eggs were parasitised by *Tetrastichus schoenobii*, Ferrière, *Telenomus* (*Phanurus*) *rowani*, Gah., *T.* (*P.*) *beneficiens*, Zehnt., *T.* (*P.*) *dignus*, Gah., and *Trichogramma japonicum*, Ashm. ; the last three, which are the commonest, parasitised more than half the egg-masses in rice seed-beds. The larvae were parasitised by *Apanteles ruficrus*, Hal., *Angitia* sp., *Eupteromalus* sp., *Bracon* (*Habrobracon*) sp., *Cremastus shirakii*, Sonan, *Amauromorpha metathoracica*, Ashm., *Elasmus albopictus*, Crwf., *Shirakia schoenobii*, Vier. (*dorsalis*, Mats.) and *Megaselia* sp., and were also attacked by predacious insects, spiders, frogs and birds, and by bacterial and fungous diseases. The larvae can be destroyed by flooding the rice stubble in spring [*cf. loc. cit.*], and complete mortality resulted in fields that were submerged for 16–18 days in February. Rice-stalks should be cut at ground level at harvest and stored so that larvae in them cannot complete their development. Other control measures recommended include the hand-collection of the egg-masses, and the use of

light-traps at the peak of emergence ; tobacco stems repelled the larvae, but were of doubtful value in the field [*cf.* **25** 231]. Late varieties of rice were less infested than early ones.

HENDRICKX (F. L.). **Un nouveau dégât occasionné par** *Dasus simplex* **F. aux caféiers** (*Coffea arabica* **L.**).—*Rec. Commun. Inst. nat. Etude agron. Congo belge* no. 1 pp. 7–11, 1 fig., 12 refs. [Yangambi] 1943.

The Tenebrionid, *Dasus simplex*, F., the distribution and food-plants of which are summarised from the literature, is common in coffee plantations in Kivu, where it occurs under dead leaves or in loose earth at the foot of the trees. The larvae feed on roots in the soil and the adults, which are described, on stems at its surface. At Kivu, the most obvious damage is the removal of rings of bark from the base of young coffee trees. The clean cultivation practised in nurseries and new plantations removes the plants preferred by the beetle, which therefore attacks the coffee trees. The young trees die if the bark is removed all round the trunk, and though they recover if a strip is left, they often become deformed and unhealthy, and should preferably be replaced by uninjured ones. The tissues at the base of the trunks of older trees are too hard to be attacked, and the beetles ring the branches instead.

During the season of 1940–41, the stems of many green healthy coffee berries that were found on the ground showed a different type of cut from those detached by *Systates*, and in a test in which three branches were covered with muslin sleeves containing no insects, ten adults of *D. simplex* and ten of *Systates*, respectively, fallen fruits in the second sleeve showed this type of cut, those in the third did not, and none fell in the first. This result was confirmed in the laboratory, and more than 23 per cent. of 32,253 injured fruits collected in March–April in an experimental plot showed evidence of damage by *D. simplex*.

Of the control measures that have been suggested, baits containing arsenicals [*cf. R.A.E.*, A **27** 127] are considered dangerous because of their toxicity to man, and protecting the base of young trees with a band of tin, though effective against the Tenebrionid and also against cutworms that attack the bark, is expensive. The best method seems to be to encourage the growth of succulent weeds, which are more attractive than bark ; if they do not become established, lupin or *Crotalaria* should be sown.

LEFÈVRE (P. C.). **Comportement de** *Helopeltis orophila* **Ghesq. sur plantes adventices et sur légumineuses.**—*Rec. Commun. Inst. nat. Etude agron. Congo belge* no. 1 pp. 50–57, 4 refs. [Yangambi] 1943.

The author describes tests on the reactions of the Capsid, *Helopeltis orophila*, Ghesquière, which is injurious to *Cinchona calisaya* var. *ledgeriana* in the Belgian Congo [*cf. R.A.E.*, A **33** 36], to weeds and leguminous hedge plants that occur in the plantations. Nymphs collected in the fourth instar and reared on leaves of *Cinchona* in the laboratory were transferred to individual petri dishes when they reached the fifth instar and provided daily with fresh flowering stems or leaves of five leguminous plants and 24 weeds of other families. The number of days each survived and its sex if it reached the adult stage are given in tables. Fifth-instar nymphs and adult males and females that were given water only did not live for more than 5, 6 and 7 days, respectively, and the 20 species of plants on which death took place within a week are therefore classified as plants that are unsuitable as food. The nine on which the Capsids survived for longer are considered to be possible food-plants. They included two leguminous plants, *Crotalaria agatifolia* and *Indigofera arrecta*, and it is recommended that hedges of these should be cut back before insecticide treatments are applied, so that they do not provide shelter for insects driven from the trees. Among the weeds that may be regarded as

food-plants, only *Commelina* sp. is abundant, and it is suggested that a weed growth dominated by the unfavourable *Galinsoga parviflora* should be encouraged in the plantations, though this must not be allowed to develop to the detriment of young *Cinchona* plants, which would then become less resistant to attack by *Helopeltis*.

JANNONE (G.). **Short Report on the Discovery of the first Outbreak Centers of *Phthorimaea operculella* Zell. (Microlepidoptera, Gelechiidae) in Eritrea and present Stage of the Infestation.**—5 pp. Asmara [Dip. Agric. Eritrea], 1943.

During March 1943, *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell., was found on both field and stored potatoes for the first time in Eritrea [*R.A.E.*, A **33** 379]. The most serious infestations were in the district of Asmara, but there were others in an area about 25 miles to the south. Brief descriptions are given of the adult, mature larva and pupa of the moth, together with notes on its world distribution, the injury it causes, and its parasites. No parasites were reared from it in Eritrea in March or April 1943 [but *cf. loc. cit.*].

[SOKOLOV (N. P.).] **Соколов (Н. П.). An experimental Hygrochamber for the Study of the Reactions of Insects to Humidity.** [*In Russian.*]—*Izv. uzbek. Fil. Akad. Nauk SSSR* 1940 no. 2–3 pp. 82–86, 2 figs. Tashkent; 1940.

The author describes and illustrates an apparatus in which insects can be exposed to a gradient of atmospheric humidity. It consists of an air-tight box of metal and glass 92 cm. long, 4·2 cm. high and 10 cm. wide, in the floor of which are seven cavities that contain petri dishes and hygrometers, arranged alternately and at equal intervals. The dish at one end contains distilled water and the other three the requisite amounts of sulphuric acid or calcium chloride, and a gradient of 10–95 per cent. relative humidity is thus obtained. The insects are introduced through one end. The hair-hygrometers employed were specially designed by N. V. Il'inskiĭ for use in the apparatus and are also described and illustrated. Tests with mosquitos showed that the chamber was satisfactory in practical use.

[DEMIDOV (N. I.).] **Демидов (Н. И.). The Effect of puncturing and sucking Insects on the Shedding of the Fruits of Cotton.** [*In Russian.*]—*Izv. uzbek. Fil. Akad. Nauk SSSR* 1940 no. 6 pp. 98–100. Tashkent, 1940.

Much of the potential yield of cotton in Bokhara is lost owing to the shedding of the fruiting forms. This is commonly ascribed to insufficient or unseasonable irrigation, but since it is considerable in fields that are correctly irrigated, observations on its cause were carried out in an experimental field in 1939. They showed that from 33 to 62 per cent. of the potential yield is lost owing to the feeding of Aphids in June and of Heteroptera in summer and autumn, the species collected in August-October being *Dolycoris penicillatus*, Horv., *Lygus pratensis*, L., *Brachynema germari*, Kol. (*virens*, Klug), *Eurydema festivum*, L., *Adelphocoris lineolatus*, Goeze, *Corizus hyoscyami*, L., and *Deraeocoris* (*Camptobrochis*) *punctulatus*, Fall. On cold mornings in October, nymphs and adults of most of the bugs occurred on the plants between the bracts and the young bolls. The stalks of most of the fallen buds, flowers and young bolls had been injured by insects, and all those so injured were shed. Older bolls survived, but did not develop to the full size, and the fibre was short and poor in quality. The conclusion that punctures by insects are a direct cause of shedding was confirmed by an experiment in which the stalks of buds,

flowers and young bolls were punctured with a needle, and dropped 6–10 days later. Bolls 2 cm. in diameter remained on the plants, but opened prematurely and produced inferior cotton.

[Brodskiĭ (A. L.).] **Бродский (А. Л.). Zoological Section of the Uzbek Branch of the Academy of Science in 1940.** [*In Russian.*]—*Izv. uzbek. Fil. Akad. Nauk SSSR* 1941 no. 1 pp. 65–72. Tashkent, 1941.

This report contains a section (pp. 69–70) in which the results are given of field tests carried out in Uzbekistan in 1940 on the use of electricity for the control of Lamellicorn larvae in the soil. It had been shown in the laboratory in 1939 that a potential gradient of 300–350 v/cm. was lethal to the larvae and that exposures of less than a second were required. The larvae are known to ascend to about 4 ins. below soil level in spring and autumn, and the tests were carried out then in an old lucerne field in which the existing population was supplemented by releasing additional larvae. The apparatus consisted of a metal frame bearing a transformer and having under it three disks that rotated on an axle. The disks were 10 ins. in diameter, were covered with insulating material, except for a narrow strip round the cutting edge, and could be raised above the soil or sunk to a depth of 4 ins. The electric current was obtained by means of a cable and an attachment that slid along a system of overhead wires. The frame was mounted on four wheels and drawn by a tractor.

The potential gradients tested ranged from 30 to 234 v/cm., and it was found that the mortality of the larvae increased directly with the increase in gradient, 91 v/cm., which was the lowest effective gradient, killing 32·4 per cent., while 210 and 234 v/cm. killed 52 and 87 per cent., respectively. The percentage mortality was little affected by the compactness of the soil, but increased with the moisture content, and was 60 when the disks were 4 ins. apart, as compared with only 0·1 when they were 16 ins. apart. It is therefore thought that six disks per axle would be more effective than three. When the potential gradient was low, adults, pupae and larvae survived for up to 9, 7 and 12–19 days, respectively, but the larvae and adults were unable to feed. The treatment was harmless to the lucerne, to beneficial soil microflora and also apparently to earthworms.

[Yakhontov (V.).] **Яхонтов (В.). Supplementa entomologica.** [*In Russian.*]—*Izv. uzbek. Fil. Akad. Nauk SSSR* 1941 no. 2 pp. 76–77, 3 figs. Tashkent, 1941.

The Bruchid, *Spermophagus* (*Euspermophagus*) *sericeus*, Geoffr., which is widely distributed in Central Asia, was thought to feed exclusively on the seeds of the noxious weed, *Convolvulus arvensis*. In 1936, however, it was found in considerable numbers in seeds of safflower [*Carthamus tinctorius*] collected in different parts of Uzbekistan, some of which had been damaged by *Heliothis* (*Chloridea*) *peltigera*, Schiff.

The Galerucid, *Monolepta russica*, Gmel., of which the feeding habits in Central Asia were unknown, was found injuring the leaves, flowers and young shoots of cultivated strawberries in the environs of Tashkent (Uzbekistan) in 1935. Similar injury had been observed on strawberries in previous years.

Occasional observations in 1932–39 in the environs of Tashkent showed that *Hibiscus cannabinus* is attacked by several species of bugs, of which the most abundant were the Capsids, *Poeciloscytus cognatus*, Fieb., *P. vulneratus*, Panz., and *Lygus pratensis*, L., and the Coreid, *Liorhyssus hyalinus*, F., and that their joint activity caused shedding of the buds and ovaries and stunting and branching of the plants, and sometimes killed young plants [*cf. R.A.E.*, A **20**. 146]. *L. hyalinus* was also observed in large numbers feeding on *Abutilon avicennae*.

Cocoons of the Pyralid, *Euzophera bigella*, Zell., which was recorded as a pest of apples in Bokhara in 1930 [**19** 595], were collected there in 1927 on a vine-stock. Adults emerged from them in the laboratory.

[Arkhangel'skiĭ (P.).] **Архангельский (П.). A little known Species of Gall Aphid on Poplar.** [*In Russian.*]—*Izv. uzbek. Fil. Akad. Nauk SSSR* 1941 no. 3 p. 78. Tashkent, 1941.

In the summer of 1937, *Mordwilkoja vesicalis*, Pass., was found in numbers on young poplars in a district in Bokhara (Uzbekistan), and the trees were disfigured by its galls. A few galls of this Aphid were also observed in the Provinces of Samarkand and Tashkent, and it has been recorded as abundant near Kushka in southern Turkmenistan. In May 1940, it was common near Tashkent on mountain poplar, *Populus suaveolens*, in association with gall Aphids of the genus *Pemphigus*, and later in the year it was found in small numbers on another species of poplar.

[Alimdzhanov (R.).] **Алимджанов (Р.). The Biology of the Nodule Weevils under Conditions of irrigated Lucerne.** [*In Russian.*]—*Izv. uzbek. Fil. Akad. Nauk SSSR* 1941 no. 4 pp. 64–70, 6 figs., 4 refs. Tashkent, 1941.

Irrigated lucerne near Tashkent (Uzbekistan) is attacked by several weevils of the genus *Sitona*, of which the adults feed on the aerial parts of the plants and the larvae on the root nodules. Observations on their bionomics were carried out in 1939–40 in experimental fields, and it was found that the species present there [*cf. R.A.E.*, A **24** 747] were *S. cylindricollis*, Fhs., which was the most abundant, *S. humeralis*, Steph., *S. callosus*, Gylh., and *S. longulus*, Gylh., which were also numerous, and *S. crinitus*, Hbst., *S. fronto*, Faust, and *S. lineellus*, Bonsd., of which the last had not previously been recorded in Central Asia. All produced one generation a year, except *S. cylindricollis*, which produced two, and hibernation occurred in the adult stage, except in *S. longulus*, which overwintered as a larva. Adults of *S. longulus* occurred from the end of June until September, and those of the other species were present throughout the year, as the overwintered ones survived until the beginning of June, when those of the following generation emerge. Oviposition continued throughout the life of the females, and the eggs were scattered at random. Females of *S. humeralis* and *S. callosus* oviposited in autumn and again in spring, and some females in captivity laid totals of over 1,000 eggs.

The eggs hatched in 8–10 days at 24–28°C. [75·2–82·4°F.], and the larval stage in all but *S. longulus* lasted 30–40 days in the field. Larvae of the last instar survived without food for up to 12 days. The heaviest damage to the main roots of the plants was caused by the overwintering larvae of *S. longulus*, which concentrated in the upper 4 ins. of soil. Pupation occurred in the upper layer of soil, and the minimum duration of the pupal stage was 5 days. Pupae developed normally on muslin in the laboratory, provided that the humidity of the air was suitable, but none produced adults at relative humidities below 70–75 per cent. The young adults remained in the soil for some time after emerging. In the case of *S. cylindricollis*, the egg, larval and pupal stages lasted 9–10, 32–38 and 5–8 days, respectively. Larvae could be found in the soil throughout the year, since those of *S. cylindricollis* were present from April to mid-June and from August to mid-September, those of *S. longulus* from July to April, and those of *S. humeralis* and *S. callosus* from April to mid-May.

[Gilyarov] Ghilarov (M. S.). **Principal Properties of injurious Insects surviving in Field Crop-rotations.**—*C.R. Acad. Sci. URSS* (N.S.) **47** no. 3 pp. 211–214, 5 refs. Moscow, 1945; also in Russian in *Dokl. Akad. Nauk SSSR* **47** no. 3 pp. 217–220, 4 refs. Moscow, 1945.

Under a system of crop rotation, the continued survival of insect pests is determined by their ability to migrate and their ability to adapt themselves to

changes in the conditions of nutrition, and these abilities, either of which compensates for the absence of the other, are usually present in inverse proportions. In most insects, migration is confined to the adult stage and feeding to the larval stage, so that if development lasts for more than a year or covers two vegetative periods, only polyphagous insects are able to survive. Examples of such insects in the Russian Union are wireworms of the genera *Agriotes* and *Corymbites* (*Selatosomus*), which require about five years for development, the Lamellicorns, *Anisoplia* spp., *Amphimallon solstitiale*, L., *Pentodon idiota*, Hbst., and *Melolontha*, which require two, three, four and four or five years, respectively, the Cistelids, *Omophlus proteus*, Kirsch, and *Podonta daghestanica*, Rttr., which require two, Tenebrionids of the genus *Blaps*, in which development lasts about 16 months, *Tipula paludosa*, Mg., the larvae of which feed during two vegetative seasons (autumn and spring) and *Tanymecus palliatus*, F., the life-cycle of which lasts two years. Of the insects that are restricted to one or a few food-plants, those that require one or more seasons for development and disperse little, such as *Dorcadion* spp., *Oria musculosa*, Hb., *Zabrus* spp. and *Crambus*, cannot become serious pests where crop rotation is practised, but those that develop in one season and migrate readily are highly injurious. Examples of the latter are *Mayetiola destructor*, Say, and *Oscinella* (*Oscinosoma*) *frit*, L., on cereals, *Cleonus* (*Bothynoderes*) *punctiventris*, Germ., *Cassida nebulosa*, L., and *Chaetocnema concinna*, Marsh., on sugar-beet, *Bruchus pisorum*, L. (*pisi*, L.) on peas, *Sitona* spp. on various leguminous crops, *Apion* spp. on red clover [*Trifolium pratense*], and *Hypera* (*Phytonomus*) *variabilis*, Hbst., on lucerne.

FLECK (E. E.) & HALLER (H. L.). **Compatibility of DDT with Insecticides, Fungicides, and Fertilizers.**—*Industr. Engng Chem.* **37** pp. 403–405, 4 refs. Easton, Pa., 1945.

The results are given of tests of some of the more common insecticides, fungicides and fertilisers for catalytic action in the dehydrochlorination of DDT. Commercial grades of sodium fluoride, sodium fluosilicate, cryolite, Paris green, calcium arsenate and lead arsenate showed no catalytic activity in decomposing DDT, and pure rotenone and pyrethrum were also inactive, but pure nicotine caused decomposition to 2,2-bis (parachlorphenyl)-1,1-dichlorethylene, which is much less effective as an insecticide. Commercial lime-sulphur and 2,3-dichlor-1,4-naphthoquinone showed no catalytic action, but mixtures of DDT with ferric dimethyl dithiocarbamate, Bordeaux mixture or sulphur resulted in the evolution of small quantities of hydrochloric acid. Accessory materials of mineral origin that may be used in the preparation of DDT dusts or be encountered in its manufacture or use were also tested, and it appeared that differences in the activity of samples of the same mineral may be due to the presence of small amounts of catalysts irregularly distributed in it. Active catalysts known at present include iron and iron oxides, chromium and anhydrous ferric, aluminium and chromic chlorides. Tests in which anhydrous ferric chloride was mixed with solutions of DDT showed that most of the solvents used for this compound, including various hydrocarbon and fatty oils, alcohols, ketones, acids and anhydrides, have a marked inhibiting action towards the catalytic decomposition reaction, the notable exceptions being naphthalene, α-chlornaphthalene and the nitro- and chlor-benzenes.

HORTON (J. R.) & HASEMAN (L.). **The Hessian Fly in Missouri.**—*Res. Bull. Missouri agric. Exp. Sta.* no. 384, 26 pp., 10 figs. Columbia, Mo., 1944.

The Hessian fly [*Mayetiola destructor*, Say] is the most destructive insect pest of winter and spring wheat in Missouri ; it is known to attack barley to a very slight extent and has been found in small numbers on several grasses, but

no evidence of migration from grasses to wheat has been obtained. The bionomics of the fly and the injury it causes are described, and the results are given of field tests carried out in 1917–35 on its control by delayed sowing of winter wheat [*cf.* *R.A.E.*, A **32** 213] and related measures ; the safe dates for sowing are shown on a map.. Outbreaks were sporadic and local and were governed largely by the distribution and amount of rainfall ; they were favoured by ample moisture in spring and in the summer after harvest. In about two-thirds of the years of the experiment, infestations were below the average for all years, and the average yields were almost identical whether the seed was sown on the safe date or before, but in the other years, when infestations were above the average, early sown winter wheat was the more heavily infested, and the grain produced was inferior in quantity and quality to that from wheat that was not sown until the safe period.

Measures that reduce adult emergence comprise the rotation of wheat with other suitable crops, which involves ploughing the stubble soon after harvest, and early ploughing where a pasture or hay crop is not sown in the stubble. Early ploughing, followed by disking and harrowing and, on some soils, by rolling, makes a compact seedbed, reduces fly emergence and prevents the growth of self-sown plants, which become infested and from which sown wheat is infested in autumn and in spring ; it also causes prompt germination, strong rooting and vigorous growth, which tend to offset the susceptibility of late-sown wheat to drought, heat, freezing and other unfavourable conditions. When an outbreak is likely, it is safer to plant rye or barley early for summer pasturage rather than wheat. Delayed sowing of wheat to avoid the bulk of the autumn emergence of the fly is the most important single method of preventing attack and consequent crop damage, particularly in view of the growing tendency to sow clovers, timothy grass [*Phleum pratense*] or other pasture or hay crops in wheat, which prevents the ploughing of the stubble.

Serious damage may be expected after a wet summer if the fly is prevalent in the stubble. This can be ascertained only by examination of the stubble, preferably shortly before harvest. When evidence throughout a district indicates that an outbreak is unlikely, it is unnecessary to adhere strictly to the fly-control programme, but if 10 per cent. or more of the stalks contain puparia and summer rainfall is normal or abundant, all stubble fields not sown with pasture or hay crops should be ploughed under and the other control measures carried out. In the absence of yearly surveys, adherence to the control programme of safe dates and related measures is the only way to prevent crop losses.

Extremely late sowing resulted in lower yields, owing to poor germination, rooting and growth of the wheat, which made it unable to withstand adverse winter conditions. In some years, such results of late sowing counteract the advantage of freedom from infestation, and sowing should therefore be begun on the safe date and completed as soon as possible.

HOFFMANN (C. H.) & ANDERSON (R. F.). **Effect of southern Pine Beetle on Timber Losses and natural Restocking.**—*J. For.* **43** no. 6 pp. 436–439, 1 fig., 5 refs. Washington, D.C., 1945.

Observations on the mortality of pine trees due to infestation by *Dendroctonus frontalis*, Zimm., have been carried out in a forest area near Asheville, North Carolina, since 1927. The forest consists mainly of hardwoods but contains some areas of pure pine and some of pine mixed with hardwoods. No serious outbreaks occurred during the period, and mortality was restricted to isolated patches, some of which were selected as plots for study. Of the trees killed, 75 per cent. were *Pinus echinata*, and the rest mainly *P. rigida*. Pure pine stands were more susceptible to attack than others, and the percentage mortality on the plots, which is shown in a table, was above 75 among pines 6 ins.

and more in diameter at breast height, and 57 and 19 in those 4 and 2 ins. in diameter, respectively. More than 75 per cent. of the stands were 20–50 years old when attacked. Observations on reproduction in the stands showing mortality indicated that the new growth in the openings formed consisted almost exclusively of hardwoods, practically all the pines present being those that survived the attack.

McGuffin (W. C.). **New Descriptions of Larvae of Forest Insects : Larvae of the Genus *Eupithecia* (Lepidoptera, Geometridae).**—*Canad. Ent.* **77** no. 3 pp. 53–55, 3 refs. Guelph, Ont., 1945.

In this part of a series on Canadian forest insects [*cf.* *R.A.E.*, A **33** 180], descriptions are given of the larvae of *Eupithecia luteata*, Pack., *E. fletcherata*, Tayl., and *E. filmata*, Pears. (striped form), which attack various conifers together with notes on the mouthparts of *E. palpata*, Pack. [**31** 173] and *E. gibsonata*, Tayl., and a key to the larvae of the five species.

[Mitchener (A. V.). Ed.] **Field Crop Insects in the Prairie Provinces.**—*Bull. Line Elevators Farm Serv.* no. 5, 64 pp., 2 col. pls., 33 figs. Winnipeg, Man., 1945.

This booklet is intended for farmers, and apart from a brief introductory section, comprises practical notes on the appearance and bionomics of the principal insects that attack field crops in Manitoba, Saskatchewan and Alberta, and recommendations for their control.

Insect Pest Control.—*Rep. Dep. Sci. Agric. Barbados 1943–44* pp. 5–7. Barbados [1945].

The mass rearing of *Trichogramma minutum*, Ril., for release against *Diatraea saccharalis*, F., on sugar-cane was continued in Barbados during 1943–44. Over 126½ million of these parasites were available for release, and liberations were made weekly during the six months of greatest growth. The percentage of internodes infested averaged 11·1. During a survey in June–July 1943 in the course of which 7,580 dead hearts were examined, no recoveries of the introduced parasites, *Lixophaga* [*diatraeae*, Tns.], *Theresia* (*Paratheresia*) [*claripalpis*, Wulp] and *Metagonistylum minense*, Tns. [*cf.* *R.A.E.*, A **29** 3–5; **30** 392; **31** 118] were made. *Diaprepes abbreviatus*, L., and *Clemora* (*Lachnosterna*) *smithi*, Arr., were only partly controlled by hand-collection, which was less generally practised than formerly. General evidence indicated an increase in numbers of both and of the damage to sugar-cane caused by them. The predacious Elaterid, *Pyrophorus luminosus*, Ill., which was introduced against *C. smithi* [**31** 118], was still present in the more hilly districts.

Laphygma eridania, Cram., was the most important pest of sweet potato and defoliated many fields. Plants subjected to artificial defoliation similar to that caused by this Noctuid developed new foliage, but the yield was reduced. The percentage losses of crop were 87·3 for plants that were defoliated twice, six and ten weeks after planting, and 63·7 and 6·5 for plants defoliated once, after eight and 12 weeks, respectively. Damage to sweet potato by *Dendrothripoides ipomeae*, Bagn., and *Empoasca solana*, DeLong, was in general slight.

Alabama argillacea, Hb., caused severe damage to cotton in some areas, chiefly owing to a scarcity of spray materials and equipment. In the continued absence of *Platyedra gossypiella*, Saund. [*cf.* **31** 118], this Noctuid constitutes the primary factor limiting cotton production. *L. frugiperda*, S. & A., *Heliothis armigera*, Hb. (*obsoleta*, F.) and *Diatraea saccharalis* caused some injury to maize, but were generally of slight importance.

BOVIEN (P.). *Proatractonema sciarae* **n. g. n. sp., a parasitic Nematode from the Body Cavity of a Dipterous Larva.**—*Vidensk. Medd. Dansk naturh. Foren.* **108** repr. 14 pp., 8 figs. 12 refs. Copenhagen, 1944.

Descriptions are given of various stages of *Proatractonema sciarae*, gen. et sp. n., found parasitising larvae of *Sciara* sp. about the roots of lily of the valley [*Convallaria majalis*] and in the soil in which they were kept in Denmark in 1943. When first observed, the Nematodes were present in about 30 per cent. of the larvae, but ten days later parasitism reached almost 100 per cent., and all the host larvae died. Notes on the bionomics of the parasite are included.

PAILLOT (A.). **Traitement des vergers contre les principaux insectes et champignons parasites.**—55 pp., 19 figs. Lyons [Union Sud-Est Synd. agric.], 1940.

This pamphlet on the control of insect pests and fungous diseases of orchard trees in south-eastern France is divided into seven chapters, the first of which deals with general considerations, chiefly regarding sprays and sprayers, the next four with measures to be taken against various insects and fungi at different seasons of the year, and the sixth with the control of *Ceratitis capitata*, Wied., on peach and pear. The seventh, under the heading of occasional treatments for miscellaneous pests, deals with *Neurotoma nemoralis*, L., on peach, apricot and cherry and *Caliroa* (*Eriocampoides*) *limacina*, Retz., principally on cherry and pear. Brief notes on the bionomics of the pests and spray calendars for apple and pear trees and for stone fruits are included.

PAPERS NOTICED BY TITLE ONLY.

FAHEY (J. E.). **Estimation of undecomposed DDT Spray Deposits on Apples from total organic Chlorine Content.**—*J. Ass. off. agric. Chem.* **28** no. 1 pp. 152–158, 1 fig., 5 refs. Washington, D.C., 1945.

LÄUGER (P.), MARTIN (H.) & MÜLLER (P.). **The Constitution and toxic Effect of Botanicals and new synthetic Insecticides** [with special reference to DDT].—43 pp., 12 figs., 5 refs. New York, N.Y., Geigy Co., Inc., 1945. [Translation, see *R.A.E.*, A **34** 43.]

BREAKEY (E. P.), GOULD (C. J.) & REYNOLDS (C. E.). **Seed-Corn Maggots** [*Hylemyia cilicrura*, Rond.] **as Pests of coniferous Seedlings in western Washington.**—*J. econ. Ent.* **38** no. 1 p. 121, 2 figs. Menasha, Wis., 1945. [*Cf. R.A.E.*, A **34** 76, but it appears that the fir seedlings were *Pseudotsuga taxifolia* and not *Abies*.]

BREAKEY (E. P.). *Phyllocoptes gracilis*, **a Pest of Red Raspberry in the Puyallup Valley.**—*J. econ. Ent.* **38** no. 1 pp. 121–122. Menasha, Wis., 1945. [*Cf. R.A.E.*, A **34** 75.]

SCHUH (J.) & ZELLER (S. M.). **Insect Pests and Diseases of Strawberry in Oregon.**—*Sta. Bull. Oregon agric. Exp. Sta.* no. 419, 40 pp., 21 figs. Corvallis, Ore., 1944. [*Cf. R.A.E.*, A **27** 498.]